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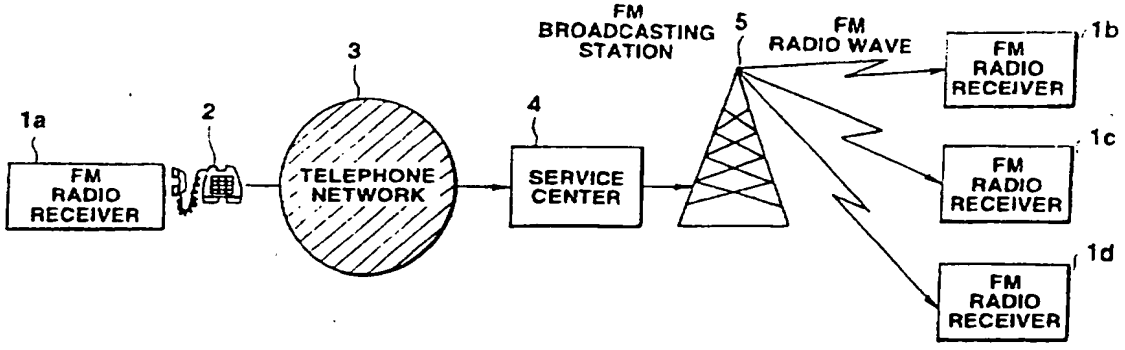

(57) Abstract

An FM broadcasting station (5) broadcasts information type identification (ID) indicating the type of on-the-air program information in subframe periods which are previously assigned to FM radio receivers (1b-1d). Each FM radio receiver (1b-1d) receives the information type ID broadcast from the FM broadcasting station (5) by performing intermittent reception in the subframe periods assigned to the FM radio receiver (1b-1d). When the received information type ID matches with a desired information type ID registered in an input data memory of that FM radio receiver (1b-1d) by a user, the FM radio receiver (1b-1d) releases intermittent reception and executes a process, such as reception and storage of program information according to the matched information type ID, reception and display of the program information, or an informing process.

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BROADCASTING SYSTEM

Technical Field

The present invention relates to a broadcasting system, a broadcasting apparatus, a broadcast receiving apparatus, and a method for use in the broadcasting system, broadcasting apparatus and broadcast receiving apparatus. This invention is particularly suitable for use in an FM (Frequency Modulation) teletext broadcasting system, but is no way limited to such application.

Background Art

There is a service available which broadcasts FM radio waves that carry display information consisting of characters, numerals and the like multiplexed on audio information, and displays the display information on the display of a receiver. This service is called "FM teletext broadcasting" which has already been put to a practical use as Visual Information Radio.

According to this FM teletext broadcasting, an FM broadcast radio wave, which is acquired by frequency-multiplexing display information consisting of characters, numerals, etc. on audio information, is transmitted from an FM broadcasting station. An FM radio receiver equipped with a display, which has received this FM teletext broadcast radio wave, separates the audio information from the display information, and displays the characters corresponding to character codes included in the display information on the display like a liquid crystal display. Accordingly, a user can watch information such as weather information or traffic information, (hereinafter called "program information"), which is provided as a teletext broadcast (display information) program, on the display. More specifically, the user can watch desired program information from plural pieces of program information by selecting the desired program from a menu of programs shown on the display.

Some program information a user wants to watch may not be broadcast frequently, but may be broadcast only during a specific period. When the user wants to watch program information which is broadcast only during a specific period, the user should perform one of, for example, the following two operations. First, the user checks a program table given in a magazine or the like, and activates an FM radio receiver, when the broadcasting time for the desired program information arrives, to receive the program information and display it on the display. Alternatively, the user

always sets the FM radio receiver powered on, stores every program information in the FM radio receiver, and later displays the desired program information among plural kinds of program information stored in the FM radio receiver to watch that program information.

The first method should however require a standby time since the activation of the FM radio receiver and thus disables the user to immediately watch the desired program information. Another shortcoming is that the user may forget the broadcasting time of the desired program information and cannot receive that program information. Further, at the broadcasting time of the desired program information, the user may not be near the FM radio receiver to operate it or may be at a location where FM broadcast radio waves cannot reach. In this case, the user cannot receive the desired program information. The second method needs the FM radio receiver to be always powered on, which results in large power consumption. Further, this method should store all program information, not just the desired program information, and thus requires a large capacity memory in the FM radio receiver.

Disclosure of Invention

It is therefore an object of the present invention to provide a broadcasting system, a broadcasting apparatus, a broadcast receiving apparatus, which can reliably and easily receive desired program information with less consumed power and a fewer memory capacity, and a method for use in the broadcasting system, broadcasting apparatus and broadcast receiving apparatus.

To achieve this object, according to one preferable mode of this invention, there is provided a broadcasting system comprising a broadcasting apparatus for broadcasting plural types of program information and broadcast receiving apparatuses for receiving and displaying program information broadcast from the broadcasting apparatus. The broadcasting apparatus includes first broadcasting means for broadcasting the plural types of program information; and second broadcasting means for broadcasting first information type data indicating a type of on-the-air program information among the plural types of program information to be broadcast. Each of the broadcast receiving apparatuses includes receiving means for receiving the plural types of program information and the first information type data, respectively broadcast by the first broadcasting means and the second broadcasting means; information type data setting means for setting second information type data;

comparison means for comparing the first information type data received by the receiving means with the second information type data set by the information type data setting means; and control means for, when comparison by the comparison means results in a match, executing a process for program information associated with the matched information type data. This broadcasting system can provide a broadcasting service which allows each broadcast receiving apparatus to reliably and easily acquire desired program information.

According to another preferable mode of this invention, there is provided a broadcasting system comprising a broadcasting apparatus for broadcasting a plurality of programs and broadcast receiving apparatuses for receiving and displaying the programs broadcast from the broadcasting apparatus. The broadcasting apparatus includes first broadcasting means for broadcasting the plurality of programs; and second broadcasting means for broadcasting first program identification data indicating an on-the-air program among the plurality of programs to be broadcast for predetermined periods previously assigned to the broadcast receiving apparatuses for receiving the on-the-air program information. Each of the broadcast receiving apparatuses includes receiving means for receiving the first program identification data broadcast by the second broadcasting means by intermittent reception for performing reception for predetermined periods previously assigned to the each broadcast receiving apparatus; program identification data setting means for setting second program identification data; comparison means for comparing the first program identification data received by the receiving means with the second program identification data set by the program identification data setting means; and control means for, when comparison by the comparison means results in a match, executing a process for program information according to the matched program identification data. This broadcasting system can provide a broadcasting service which allows each broadcast receiving apparatus to reliably and easily acquire desired program information.

Brief Description of Drawings

FIG. 1 is a diagram illustrating the general structure of an FM teletext broadcasting system according to one embodiment of this invention;

FIG. 2 is a block diagram illustrating the circuit structure of an FM radio receiver according to this embodiment;

FIG. 3 is a diagram showing information type IDs and contents associated

with the information type IDs, both stored in an EEPROM in FIG. 2;

FIG. 4 is a diagram depicting the circuit structure of a broadcasting apparatus provided in an FM broadcasting station according to this embodiment;

FIG. 5 is a diagram showing the structure of a frame in a transmission format of FM teletext broadcast according to this embodiment;

FIG. 6 is a diagram depicting how frame data in the transmission format of FM teletext broadcast according to this embodiment is divided into a plurality of subframes;

FIG. 7 is a diagram illustrating the relationship between packet numbers for subframes and the lower four bits of IDs according to this embodiment;

FIG. 8 is a diagram showing a bit pattern of block identification codes according to this embodiment;

FIG. 9A is a diagram showing the schematic structure of a data packet in FM teletext broadcast according to this embodiment;

FIG. 9B is a diagram showing the structure of a prefix in the transmission format of FM teletext broadcast according to this embodiment;

FIG. 10 is a diagram showing the structure of a data group in the case of paging data according to this embodiment;

FIG. 11 is a diagram showing the structure of scramble information constituting a segment according to this embodiment;

FIG. 12 is a diagram showing the structure of substitute frequency information constituting a segment according to this embodiment;

FIG. 13 is a diagram depicting the structure of paging information (paging data) constituting a segment according to this embodiment;

FIG. 14 is a diagram depicting a data structure when paging information is data for an information type according to this embodiment;

FIG. 15 is a diagram illustrating codes for the operation modes of the receiver and the contents associated with the operation modes;

FIG. 16 is a diagram depicting a data structure when a data group is program management data or paging data in program data according to this embodiment;

FIG. 17 is a diagram showing the structure of program data according to this embodiment;

FIGS. 18A and 18B are diagrams depicting the structure of program

management data according to this embodiment;

FIGS. 19A and 19B are diagrams depicting the structure of page data according to this embodiment;

FIG. 20 is a flowchart for explaining the operation of the FM radio receiver according to this embodiment;

FIG. 21 is a flowchart for explaining the operation of the FM radio receiver according to this embodiment;

FIG. 22 is a flowchart for explaining the operation of the FM radio receiver according to this embodiment;

FIGS. 23A through 23E present a timing chart for explaining the operation of the FM radio receiver according to this embodiment;

FIG. 24 is a diagram showing information type IDs and information contents of the operation modes of the receiver, which are registered in association with each other in an input data memory in FIG. 2 according to another embodiment.

FIG. 25A is a diagram showing program index Nos. and program index names corresponding to a program category No, a program category name and a program category according to another embodiment of the present invention; FIG. 25B is a diagram showing program index Nos. corresponding to a program category No. and a program category name according to this embodiment;

FIG. 26 is a diagram showing the structure of information type data group according to this embodiment;

FIG. 27 is a diagram showing data unit data according to this embodiment;

FIGS. 28 to 31 are flow charts explaining the processing performed in FM radio receivers according to this embodiment; and

FIGS. 32A and 32B are time charts showing the operations of the FM radio receivers according to this embodiment.

Best Modes for Carrying Out the Invention

One embodiment of the present invention as adapted to an FM teletext broadcasting system will now be described referring to the accompanying drawings.

FIG. 1 shows the general structure of the FM teletext broadcasting system. In this figure, reference numeral "1a" denotes an FM radio receiver which is about to make paging. The FM radio receiver 1a has an auto dial function in addition to a selective paging data receiving function. As a user presses the

speaker of the FM radio receiver 1a against the transmitter of a telephone 2 to send out DTMF (Dual Tone Multi Frequency) signals according to a previously input paging number and message data from that speaker, paging data including the paging number and message data is sent via a telephone network 3 to a service center 4.

The user can also make a paging request by dialing the service center 4 and giving the paging number and message data by voices.

The service center 4 transmits the paging data, sent via the telephone network 3 from the FM radio receiver 1a, together with paging data sent from other receivers, to an FM broadcasting station 5 which has been consigned to broadcast those paging data. The FM broadcasting station 5 transmits FM broadcast radio waves which have those paging data multiplexed as display information on audio information.

The FM broadcast radio waves transmitted from the FM broadcasting station 5 are received by FM radio receiver 1b to 1d which are located in the broadcasting area of the FM broadcasting station 5 (where the FM broadcast radio waves can reach). When determining that the paging number in the received paging data matches with its own paging number, each of the FM radio receivers 1b-1d informs a user of its being paged.

FIG. 2 illustrates the circuit structure of each of the FM radio receivers 1a to 1d. In this figure, a reception section 12 is connected to an antenna 11. This reception section 12 has an FM tuner 121 and an FM demodulator 122. The FM tuner 121 tunes the frequency of the FM radio wave received at the antenna 11. The FM demodulator 122 demodulates the FM signal, tuned by the FM tuner 121, to yield stereo signals (L+R signal and L-R signal). A switch 123 serves to permit or inhibit power supply to the reception section 12.

An audio information reproducing section 13 is connected to the FM demodulator 122 of the reception section 12. This audio informa n reproducing section 13 has a stereo demodulator 131 and amplifiers 132 and 3. The stereo demodulator 131 demodulates the stereo signal, which is the demodulated signal from the FM demodulator 122, to yield an L signal and an R signal. The L signal and R signal are sent through the respective amplifiers 132 and 133 to speakers 135 and 136 from which they are output as a stereo sound. A switch 134 serves to permit or inhibit power supply to the audio information reproducing section 13.

A multiplexed information reproducing section 14 has an L-MSK (Level controlled Minimum Shift Keying) demodulator 141, an error correction decoder 142 and a block identification code detector 143. The L-MSK demodulator 141 separates and demodulates a multiplexed signal (signal of display information), which has undergone digital modulation to change the multiplex level by 4% to 10% in accordance with the level of the L-R signal and has been multiplexed on an audio signal. The error correction decoder 142 performs error correction on the display information based on CRC and parities (discussed later). The error correction decoder 142 sends the display information, demodulated by the L-MSK demodulator 141, to a CPU (Central Processing Unit) 15. The block identification code detector 143 detects a block identification code in the transmission format of the display information, which will be discussed later. The block identification code detector 143 sends the detected block identification code to the CPU 15. A switch 144 serves to permit or inhibit power supply to the multiplexed information reproducing section 14.

Connected to the CPU 15 are a microcomputer 10, an alerting section 16, a display section 17, a key input section 18, a ROM (Read Only Memory) card 19, an EEPROM (Electrically Erasable and Programmable Read Only Memory) 20, a reception data memory 21, a fixed message memory 22, an input data memory 23 and a transmission buffer 24.

The microcomputer 10 switches the tuning frequency of the FM tuner 121 in accordance with a channel selecting operation done through the key input section 18. The alerting section 16 informs the user of the FM radio receiver 1a, 1b, 1c or 1d being paged, via an unillustrated driver. The display section 17 displays a message consisting of characters and/or numerals or the like, sent as the display information. The key input section 18 has various kinds of keys. When any key on the key input section 18 is operated, its associated key-in signal is sent to the CPU 15.

The ROM card 19 stores a processing program for the CPU 15 and the paging number (personal ID) of its FM radio receiver. This ROM card 19 is comprised of a magnetic or optical recording medium, or a recording medium like a semiconductor memory. The ROM card 19 is to be detachably attached to the body of the associated FM radio receiver 1a (1b, 1c, or 1d). A ROM which can replace the ROM card 19 may be permanently installed in the FM radio receiver 1a (1b, 1c, or 1d). The program, data or the like to be recorded on the recording medium may be received from another unit which is connected to the FM radio receiver 1a (1b, 1c, or

1d) via a communication line or the like. Alternatively, a storage device equipped with the aforementioned recording medium may be provided in another unit which is connected to the FM radio receiver 1a (1b, 1c, or 1d) via a communication line or the like, so that the program and data recorded on this recording medium can be used via the communication line.

The EEPROM 20 stores data for error correction of the display information received by the error correction decoder 142. The EEPROM 20 also stores a table having information type IDs and the types of program information corresponding to the information type IDs shown in FIG. 3. (Those types will hereinafter be called "information types".)

The information types in the table in FIG. 3 can be displayed in the form of a list on the display section 17 by operating a predetermined key on the key input section 18. As the user selects any one of the information types displayed on the display section 17 through a predetermined key operation, the information type ID corresponding to that information type can be registered in the input data memory 23.

The table shown in FIG. 3 may be registered in the EEPROM 20 before the shipment of the FM radio receivers 1a-1d. Alternatively, the table shown in FIG. 3 may be broadcast so that each of the FM radio receivers 1a-1d receives this table and registers it in the EEPROM 20. Furthermore, the table shown in FIG. 3 may be registered in the ROM card 19.

The reception data memory 21 stores the received display information. This reception data memory 21 has an area for storing message data associated with paging, a temporary storage area for storing the latest program data, and an selected program information storage area for storing program information corresponding to the information type ID which is the same as the information type ID, selectively registered in the input data memory 23 by a process to be discussed later, when this information type ID is received.

The fixed message memory 22 previously stores fixed messages in association with fixed message numbers.

The input data memory 23 stores the paging number of the destination, entered by the key operation of the key input section 18, and message data like a fixed message number in addition to the aforementioned selected information type ID.

The transmission buffer 24 temporarily stores data entered by the operation of keys on the key input section 18 or the paging number and message

data, which are selected from the stored data in the input data memory 23. The transmission buffer 24 sends those temporarily stored data to a DTMF signal generator 25. The DTMF signal generator 25 generates a DTMF signal corresponding to the signal sent from the transmission buffer 24. The generated DTMF signal is sent through an amplifier 26 to a speaker 27 from which it is sent out.

The CPU 15 performs the general control of the above-described circuits in accordance with the processing program stored in the ROM card 19.

FIG. 4 shows the structure of a broadcasting apparatus provided in the FM broadcasting station 5. This broadcasting apparatus includes a transmission section 31, a multiplexed data processing section 32 and a transmission processing section 33.

The transmission processing section 33 sends information, such as program information or paging information, to the multiplexed data processing section 32. The multiplexed data processing section 32 has an encoding section 38, a multiplexing section 39, and error correction affixing unit 40 and an L-MSK modulator 41. The encoding section 38 encodes the information supplied from the transmission processing section 33. The multiplexing section 39 separates the information, encoded by the encoding section 38, to frames and blocks of the transmission format (which will be described later) in order to transmit the information as FM teletext broadcast information. The error correction affixing unit 40 affixes an error correction code (a parity and CRC (Cyclic Redundancy Code) to be discussed later) to the information separated by the multiplexing section 39. The L-MSK modulator 41 performs L-MSK modulation on the information with the error correction code affixed by the error correction affixing unit 40 so that the level of the multiplexed signal (which is the signal of the display information) is changed by 4% to 10% in accordance with the level of modulation of the L-R signal.

The transmission section 31 includes a stereo modulator 34, an FM modulator 35, a transmitter 36 and an antenna 37. The stereo modulator 34 performs stereo modulation on audio information consisting of an L signal and R signal to yield a stereo signal consisting of an L+R signal and L-R signal. The stereo modulator 34 frequency-modulates the L+R signal, L-R signal and the multiplexed signal output from the L-MSK modulator 41. The FM modulator 35 performs FM modulation on the output signal of the stereo modulator 34 and outputs the resultant signal. The transmitter 36 sends out the FM signal, output from the FM modulator

35, from the antenna 37 as an FM broadcast radio wave.

FIG. 5 shows the structure of one frame of the multiplexed signal (the signal of display information) transmitted from the FM broadcasting station 5. One frame is comprised of 272 blocks each having a 16-bit block identification code (BIC) affixed to the head of each block to establish the block synchronization and frame synchronization.

Of the 272 blocks, 190 blocks serve as data packets for transferring data, such as information type ID and program data, and the remaining 82 blocks serve as parity packets for transferring parities in the column direction (vertical parities). The 82 parity packets represent the vertical parities of the entire data, and are distributed as shown in FIG. 5 to cope with a burst error.

In this embodiment, 16 subframes are set in a single frame for a selective paging service as shown in FIG. 6. In this case, parity packets up to packet No. 136 are the first half of a frame. The data packets, which are included in packet Nos. 3 to 13 and whose block identification code is BIC1, are set as a subframe 0, the data packets, which are included in packet Nos. 14 to 29 and whose block identification code is BIC3, are set as a subframe 1, and likewise the data packets, which are included in packet Nos. 113 to 128 and whose block identification code is BIC2, are set as a subframe 7.

The parity packets on and after packet No. 137 are treated as the second half of the frame. The data packets, which are included in packet Nos. 139 to 149 and whose block identification code is BIC2, are set as a subframe 8, the data packets, which are included in packet Nos. 150 to 165 and whose block identification code is BIC3, are set as a subframe 9, and likewise the data packets, which are included in packet Nos. 249 to 264 and whose block identification code is BIC3, are set as a subframe 15.

The individual subframes No. 0 to No. 15 correspond to data of the lower four bits (lower fourth bit to first bit) in a paging ID code (28-bit structure) or a paging number which is given to each of the FM radio receivers 1a-1d described above. In other words, each FM radio receiver 1a, 1b, 1c, or 1d belongs to any one of sixteen groups separated based on the data of the lower four bits in its own ID code. Each FM radio receiver 1a, 1b, 1c, or 1d is designed to be able to intermittently receive the subframes that correspond to the group to which this FM radio receiver substantially belongs.

FIG. 7 illustrates the relationship between the packet numbers for subframes No. 0 to No. 15 and the lower four bits of the ID code. The bit pattern of a 16-bit block identification code at the head of each block is shown in FIG. 8. The FM radio receivers 1a-1d can identify the timings of switching the packets by detecting the block identification codes (BIC1 to BIC4). The FM radio receivers 1a-1d can also identify the start timings of a frame based on a change in the block identification codes.

In the case of affixed information like paging information, each of data packets constituting each subframe consists of a total of 176 bits, which are 16 bits of a prefix and 160 bits of a data block, 14 bits of CRC and 82 bits of a parity, as shown in FIG. 9A.

As shown in FIG. 9B, each 16-bit prefix consists of a 4-bit service ID code, a 1-bit decoding ID flag, a 1-bit information end flag, a 2-bit update flag, a 4-bit data group number and a 4-bit data packet number.

The 4-bit service ID code located at the head of each prefix is used to identify the data contents of a data packet. When the service ID code is "0011," it indicates that the data packet carries paging information. When the service ID code is "1100," "0100," "1100," "0010," "1010" or "0110," it indicates that the data packet carries program data such as characters, a figure or traffic information.

The 1-bit decoding ID flag indicates an error correction method which is performed by the error correction decoder 142. When the decoding ID flag is "1," the error correction decoder 142 in the FM radio receiver 1a, 1b, 1c, or 1d executes error correction only in the horizontal direction, and sends the data of that data packet to the CPU 15. When the decoding ID flag is "0," the error correction decoder 142 in each of the FM radio receivers 1a-1d executes error correction in both the horizontal and vertical directions, and sends the data of that data packet to the CPU 15. In an exclusive radio paging mode, since each of the FM radio receivers 1a-1d intermittently receives only those subframes assigned to itself, the decoding ID flag is "1." The 1-bit information end flag is set to "1" when information ends at a data group to be transferred with a given data group number, and is set to "0" otherwise. The 2-bit update flag is incremented by "1" when the contents of data in a data group to be transferred with a given data group number are updated.

The 4-bit data group number indicates the data group number which is assigned when the data group is transmitted. The lower four bits of the paging ID code are set to the 4-bit data group number when the service ID code is "0011."

Accordingly, the numbers of blocks of a frame to be transmitted are determined for each data group number to ensure intermittent reception which saves the battery power. The 4-bit data packet number indicates the number of a data packet to be sent for each data group number. The data packet numbers are sequentially assigned in order from "0."

Each data group consists of one or more than one 160-bit data block. In the case of paging data, the data group consists of a segment 1 (scramble information), a segment 2 (substitute frequency information) and a segment 3 (paging information), as shown in FIG. 10. NULL is data to be inserted into an excess portion to adjust the length of the data group. All the information of the segments 1-3 should not necessarily be sent out. The information of the segments 1 and 2 have long transmission intervals.

The segment 1 (scramble information) consists of a 4-bit segment ID, a 4-bit number of segment data bytes, a 2-byte paging provider number and a 2-byte scramble flag, as shown in FIG. 11. In this case, the segment ID is set to "0001" indicating scramble information. The number of segment data bytes is fixed to "0100" ("4" in the decimal notation). The paging provide number is a flag for discriminating a paging provider. The scramble flag is information necessary for descrambling.

As shown in FIG. 12, the segment 2 (substitute frequency information) consists of a 4-bit segment ID, the number of segment data bytes consisting of 4 bits (or 4 bits + 1 byte), a 1-byte reference broadcasting station frequency, and an N-byte substitute frequency (first to the N-th). In this case, the segment ID is set to "1010" indicating substitute frequency information. When the number of segment data bytes becomes equal to or greater than "15," the first 4-bit area of the field of the number of segment data bytes is set to "1111" and data indicating the number of segment data bytes is set in the next 1-byte area. There are M segments 2.

As shown in FIG. 13, the segment 3 (paging information) consists of a 4-bit segment ID, the number of segment data bytes consisting of 4 bits (or 4 bits + 1 byte), a 2-byte ID group identification flag, a 2-bit ID code (MID), 6-bit data on the number of pagings, and a personal ID group. In this case, the segment ID is set to "1101" indicating paging information. The number of segment data bytes is expressed only by four bits until its value is "14." When the number of segment data bytes becomes equal to or greater than "15," the first 4-bit area of the field of the number of segment data bytes is set to "1111" and data indicating the number of segment data bytes is

set in the next 1-byte area.

The ID group identification flag consists of 16-bit flag data. The FM radio receivers 1a-1d are separated into sixteen groups based on the lower four bits of the ID code. Each group of the FM radio receivers is further separated into sixteen subgroups based on the lower eight to fifth bits of the ID code. The ID group identification flag data, when any of its 16 bits is "1," indicates that any one of the FM radio receivers 1a-1d belonging to a group specified by that bit of "1" is being paged. For example, b5 (upper byte) = 1 indicates that any of the FM radio receivers 1a-1d with the ID code whose lower eighth to fifth bits are "0101" ("5" in the decimal notation) is being paged.

When the ID code MID is "00" ("0" in the decimal notation) or "01" ("1" in the decimal notation), it indicates that the personal ID is written in the segment 3. The number of pagings N indicates the number of the FM radio receivers 1a-1d which are individually paged. The personal ID group is comprised of first to N-th paging data each consisting of upper 24 bits (28-th to fifth bits) of the associated one of the personal IDs of the paged FM radio receivers 1a-1d.

When the ID code MID is "0," a personal ID with no message, which will be discussed later, is written in the personal ID group. In this case, as shown in FIG. 13, the number of pagings (N) and the upper 24 bits (28-th to fifth bits) of the personal ID as each of the first to N-th paging data are written after the ID code MID. When the ID code MID is "1," a personal ID with a message, which will be discussed later, is written in the personal ID group. In this case, as shown in FIG. 13, the number of pagings (M), the first to M-th paging data and a message data group are written after the ID code MID. Affixed to the head of each message data is data indicative of the type of characters and the length of the message data. When the value of the character type consisting of two bits is "00," the message data is fixed message data. When the value of the character type is "01," the message data is numerical data consisting of four bits per character. When the value of the character type is "10," the message data is alphabet data consisting of one byte per character.

When the ID code MID is "10" ("2" in the decimal notation), the segment 3 includes an information type data group which indicates the types of on-the-air program. In this case, the bits of the ID group identification flag are all "1." In this case, as shown in FIG. 14, the number of information type data (N) and the first to N-th information type data follow the ID code MID. The information type data consists of

an information type ID, the number of selection control data, and selection control data, which includes a destination page number indicating a program including information indicated by the information type ID and a page, and a destination program number (only when transmission is necessary). Affixed to the head of the selection control data is 2-bit control data for designating the operation mode of the associated receiver. As shown in FIG. 15, the control data whose value is "0" ("00" in the binary notation) indicates a mode for performing only program data storage in the selected program data storage area in the reception data memory 21 when program data corresponding to the information type ID registered in the input data memory 23 is received. The control data whose value is "1" ("01" in the binary notation) indicates a mode for storing program data and causing the alerting section 16 to inform the user of the desired program data being received. The control data whose value is "2" ("10" in the binary notation) indicates a mode for effecting similar informing and temporarily storing the program data in the temporary storage area in the reception data memory 21 to display it on the display section 17. The control data whose value is "3" ("11" in the binary notation) indicates a mode for effecting only the mentioned informing. This control data can be selected and broadcast as needed by the FM broadcasting station 5. For example, the control data may be changed in accordance with a program type or may be fixed to specific control data.

One segment 3 (paging information) can include plural types of ID codes MID.

In the case of program data for transmitting program information, each data packet consists of a total of 176 bits, which are 32 bits of a prefix and 144 bits of a data block, 14 bits of CRC and 82 bits of a parity. Since the prefix for program data has the same structure as that of a prefix for paging data except for the difference in the number of bits, the detailed description on the structure will not be given.

Each data group consists of one or more than one 144-bit data block. The data group consists of a heading start code, a data group header, program management data or page data, and a data group end code. The heading start code and the data group end code each consist of eight bits. NULL is data to be inserted into an excess portion to adjust the length of the data group.

FIG. 17 shows the structure of program data which consists of the aforementioned program management data and one or plural pieces of page data.

The program management data consists of a program data header as the

data header of the program management data and a data unit group.

The page data consists of a page data header as the data header of the page data and a data unit group.

FIG. 18A shows the structure of the program data header, which consists of a 2-byte data header ID and 4-byte data header data. The data header ID consists of an 8-bit information separation code (RS) and an 8-bit data head parameter. The data header data consists of an 8-bit program number, a 2-bit update flag indicating renewal for each program, 6-bit data on the total number of pages constituting a program, 8-bit presentation function data representing the type of the code included in the program and the presentation function, 4-bit information category data for identifying the information category of the program contents, and 4-bit display format data for designating the display mode.

FIG. 18B shows the structure of each of data units constituting a data unit group. The data unit includes a data unit ID consisting of an 8-bit data unit separation code (US) and an 8-bit data unit parameter. The data unit further consists of a 1-bit data unit link flag (DUL) indicating the link of the data unit, a 15-bit data unit size indicating the byte length of data unit data and a maximum of 32,767 bytes of data unit data.

FIG. 19A shows the structure of the page data header which consists of a 2-byte data header ID and 5-byte data header data. The data header ID consists of an 8-bit information separation code (RS) and an 8-bit data head parameter. The data header data consists of an 8-bit program number, a 2-bit update flag indicating renewal of the contents for each page, a 6-bit page number of a program, 8-bit presentation function data representing the type of the code included in the page, 4-bit information category data for identifying the information category of the page contents, 4-bit display format data for designating the display mode, 4-bit header raster color data indicating the raster color of the header display area by the lower address of a color map, and 4-bit raster color data indicating the raster color of the main text display area by the lower address of the color map.

FIG. 19B shows the structure of each of data units constituting a data unit group. As this structure is the same as that shown in FIG. 18B, its description will be omitted.

The reception operation of the FM radio receivers 1b-1d which receive the above-described multiplexed data will now be discussed.

In the case where one listens to an ordinary FM radio broadcast program by any of the FM radio receivers 1b-1d, a control line B is rendered active to set on the switches 123 and 134 in response to an instruction given from the CPU 15 in association with the key operation of the key input section 18. As a result, the reception section 12 and the audio information reproducing section 13 are powered on.

When FM broadcast radio waves are received at the antenna 11 under this situation, they are tuned by the FM tuner 121 and then demodulated by the FM demodulator 122. A stereo audio signal (L+R signal and L-R signal), which is the demodulated signal from the FM demodulator 122, is separated into an L signal and an R signal by the stereo demodulator 131 and audio sounds corresponding to the separated L signal and R signal are output via the respective amplifiers 132 and 133 from the speakers 135 and 136.

In the case where one wants to listen to an ordinary FM radio broadcast program and watch an FM teletext broadcast program using any of the FM radio receivers 1b-1d, a control line A is rendered active to set on the switches 123, 134 and 144 in response to an instruction given from the CPU 15 in association with the key operation of the key input section 18. As a result, the reception section 12, the audio information reproducing section 13 and the multiplexed information reproducing section 14 are all powered on.

In this case, while the aforementioned reception of audio information is performed, the L-MSK demodulator 141 separates and demodulates the multiplexed signal, which is then subjected to error correction in the error correction decoder 142, and the resultant signal is displayed as character information on the display section 17 in accordance with an instruction from the CPU 15.

In the case where one wants to watch an FM teletext broadcast program, a control line C is rendered active to set on the switches 123 and 144. As a result, the reception section 12 and the multiplexed information reproducing section 14 are powered on. When the intermittent reception mode is designated, the CPU 15 sends a battery saving signal onto the control line C.

When the user registers the information type ID of information to be stored in the FM radio receiver 1, first, the user should operate a predetermined key on the key input section 18 to display the contents of the information types shown in FIG. 3 on the display section 17. Then, the user should operate a predetermined key on the key input section 18 to select the contents of a desired information type from the

contents of the information types displayed on the display section 17. As a result, the associated information type ID is stored in the input data memory 23.

When the intermittent reception mode is designated by the operation of a predetermined key on the key input section 18, the FM radio receiver 1 causes the CPU 15 to send the battery saving signal onto the control line C to intermittently receive a subframe belonging to itself.

FIGS. 20 through 22 illustrate flowcharts for the case where the intermittent reception mode is designated. When the intermittent reception mode is designated, the FM radio receiver 1 first waits for the timing to start receiving its subframe (step A1). When the reception start timing for the subframe to the FM radio receiver has come in step A1, the reception section 12 and the multiplexed information reproducing section 14 are powered on in response to an instruction given from the CPU 15 (step A2).

It is then determined if a reception end timing for the subframe for the FM radio receiver has arrived (step A3). When it is determined in step A3 that the reception end timing for that subframe has not arrived yet, it is determined if the service ID code in the prefix in a data packet constituting this subframe is for paging information (step A5).

When it is determined in step A3 that the reception end timing for the subframe has arrived, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step A4). The processing returns to step A1 to wait for the reception start timing for the subframe to the FM radio receiver.

In this case, as shown in FIG. 23B, those sections are powered up at the reception start timing of its subframe in one frame, e.g., a subframe 7, shown in FIG. 23A. When the service ID code of the subframe is not for paging information, the reception section 12 and the multiplexed information reproducing section 14 are powered off at the reception end timing for its subframe. If the FM broadcasting station always inserts paging information in a data packet at the head of each subframe before transmission, each of the FM radio receivers 1a-1d can power off the reception section 12 and the multiplexed information reproducing section 14 when determining that the service ID code in the data packet at the head of the subframe is not for paging information.

When it is determined in step A5 that the service ID code in the prefix in

the data packet constituting the subframe is for paging information, it is determined if the bit corresponding its ID number in the ID group identification flag in the paging information shown in FIG. 13 is "1" by referring to paging data (see FIG. 10) in the data packet constituting this subframe (step A6).

When it is not determined in step A6 that the bit is "1," the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step A7). The processing then returns to step A1 to wait for the reception start timing for the subframe to the FM radio receiver. That is, if the bit corresponding its ID number in the ID group identification flag is not "1," the reception section 12 and the multiplexed information reproducing section 14 are powered off when this determination is made.

When it is determined in step A6 that the bit is "1," it is determined if the ID code MID received following the ID group identification flag is "2" ("10" in the binary notation) (step A8). When it is not determined in step A8 that the ID code MID is "2," the ID code MID is "0" ("00" in the binary notation). In this case, the first to N-th paging IDs with no message and the first to M-th paging IDs with a message in the paging information shown in FIG. 13 are searched for its paging ID (step A14).

It is then determined if its paging ID has been detected in the search in step A14 (step A15). When it is determined in step A15 that its paging ID has not been detected, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step A23). That is, when its paging ID cannot be detected in the search of paging IDs in the transmission format of the subframe 7 shown in FIG. 23C, the reception section 12 and the multiplexed information reproducing section 14 are powered off as shown in FIG. 23D.

Next, it is determined if the selection control data corresponding to the information type ID registered in the input data memory 23 is stored in the internal register of the CPU 15 by the process which will be discussed later (step A24). When it is determined in step A24 that no selection control data is stored in the internal register, the processing returns to step A1 to wait for the reception start timing for the next subframe to the FM radio receiver.

When it is determined in step A15 that its paging ID has been detected, it is determined if this paging ID is accompanied with a message (step A16). When it is determined in step A16 that the paging ID is accompanied with no message, the

control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step A21). Then, the alerting section 16 is activated in response to an instruction from the CPU 15 to start informing the user of the FM radio receiver 1a, 1b, 1c, or 1d being paged (step A22).

Then, it is determined if the selection control data corresponding to the information type ID registered in the input data memory 23 is stored in the internal register of the CPU 15 by the process which will be discussed later (step A24). When it is determined in step A24 that no selection control data is stored in the internal register, the processing returns to step A1 to wait for the reception start timing for the next subframe to the FM radio receiver.

When it is determined in step A16 that the paging ID is accompanied with a message, the paging information shown in FIG. 13 is searched for a message addressed to the FM radio receiver (step A17). Then, the searched message is stored in the reception data memory 21 (step A18). Next, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 as shown in FIG. 23E (step A19). Then, the alerting section 16 is activated in response to an instruction from the CPU 15 to start informing the user of the FM radio receiver 1a, 1b, 1c, or 1d being paged (step A20). Further, the message addressed to the FM radio receiver, stored in the reception data memory 21, is displayed on the display section 17.

Next, it is determined if the selection control data corresponding to the information type ID registered in the input data memory 23 is stored in the internal register of the CPU 15 by the process which will be discussed later (step A24). When it is determined in step A24 that no selection control data is stored in the internal register, the processing returns to step A1 to wait for the reception start timing for the next subframe to the FM radio receiver.

When it is determined in step A8 that the ID code MID is "2" ("10" in the binary notation), it is determined, from the number of information types following the ID code MID, how many kinds of information have currently being broadcast (step A9). This determination is made to later determine the end of the information type data group.

When the determination on the number of information types is ended, the

information type ID registered in the input data memory 23 by the user prior to reception is compared with one information type ID in the information type data group to determine if both match with each other (step A10).

When the determination on both information type IDs results in a match in step A10, the selection control data following the matched information type ID is entirely stored in the internal register of the CPU 15 (step A11). Then, it is determined if the comparison of the registered information type ID with all the information type IDs received has been completed (step A12). If the comparison is not completed, the processing returns to step A10 to continue the comparison for the remaining information type IDs received. When it is not determined in step A10 that both information type IDs match with each other, the processing proceeds to step A12 without executing the process in step A11.

When it is determined in step A12 that the comparison of the registered information type ID with all the information type IDs received has been completed, it is determined whether or not there is an ID code MID whose value is "0" ("00" in the binary notation) (step A13).

When it is determined in step A13 that an ID code MID whose value is "0" exists, processing associated with normal paging, which starts at step A14, is performed. When it is determined in step A13 that no ID code MID whose value is "0" exists, as in step A24, it is determined if the selection control data corresponding to the information type ID registered in the input data memory 23 is stored in the internal register of the CPU 15 by the process which will be discussed later (step A25). When it is determined in step A25 that no selection control data is stored in the internal register, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step A26). The processing then returns to step A1 to wait for the reception start timing for the next subframe to the FM radio receiver.

In other words, when the ID code MID whose value is "2" is included in the paging information, none of the information type IDs received match with the registered information type ID and no ID code MID whose value is "0" is present, the reception section 12 and the multiplexed information reproducing section 14 are powered off after the existence of no selection control data in the internal register of the CPU 15 is confirmed in step A25.

When it is determined in step A25 that selection control data is stored in

the internal register, the intermittent reception mode is released and the mode is changed to the normal program information reception mode (step A27). Then, processing associated with the program which is selected by the destination program number and destination page number in the stored selection control data is executed in accordance with the information content of the receiver's operation mode (step A28).

FIG. 22 illustrates the detailed flow of step A28.

First, it is determined in step B1 what is the information content of the receiver's operation mode in the selection control data stored in the internal register of the CPU 15.

When the information content of the receiver's operation mode is determined to be "0," the flow proceeds to step B2 to wait for the reception of the program data whose program number coincides with the destination program number in the selection control data.

When the reception of that program data is detected, the page data with the page number in the selection control data is stored in the selected program data storage area in the reception data memory 21 (step B3).

When no destination page number is presets in the selection control data, all the program data with the destination program number are stored.

When it is determined in step B1 that the information content of the receiver's operation mode is "1," the flow proceeds to step B4 to wait for the reception of the program data whose program number coincides with the destination program number in the selection control data.

When the reception of that program data is detected, the page data with the page number in the selection control data is stored in the selected program data storage area in the reception data memory 21 in step B5, after which the alerting section 16 is activated to effect the informing process (step B6).

In this case, the user can immediately know that the program data of the desired information type has been receiver and stored, and can thus watch the desired program without delay by operating a read key on the key input section 18 to read the program data from the selected program data storage area and display it on the display section 17.

When it is determined in step B1 that the information content of the receiver's operation mode is "2," the flow proceeds to step B7 to wait for the reception of the program data whose program number coincides with the destination program

number in the selection control data.

When the reception of that program data is detected, the paging data with the page number in the selection control data is temporarily stored in the temporary storage area in the reception data memory 21 and the stored page data is displayed on the display section 17 in step B8. In the next step B9, the alerting section 16 is activated to effect the informing process.

In this case, the user can immediately know that the program data of the desired information type has been received and stored, and can thus watch the desired program without delay and without operating any key.

As the program data is stored in the temporary storage area which updates and stores only the latest program data in step B8, a large memory capacity is not required. This technique is effective for programs which become valueless when they get old.

Although program data is stored in the temporary storage area in step B8, it may be stored in the selected program data storage area.

When it is determined in step B1 that the information content of the receiver's operation mode is "3," the flow proceeds to step B10 where the alerting section 16 is activated to effect the informing process.

In this case, since the user can immediately know that the program data of the desired information type has been received and stored, the user can receive and display the desired program data by performing the menu key operation of the key input section 18 to display a menu on the display section 17 and select the desired program from the menu, as done in the ordinary case of watching program data.

In this case, the FM radio receiver 1 is relieved of some processing.

When the information content of the receiver's operation mode is "3," only the informing process is performed so that the intermittent reception mode need not be released in step A27.

When it is determined in step A24 or A25 that plural pieces of selection control data are stored in the internal register of the CPU 15, the selection control data processing in FIG. 22 is executed in parallel for the number of the selection control data.

After the process in step A28 is completed, the processed selection control data stored in the internal register of the CPU 15 is erased (step A29) and the intermittent reception mode is set again (step A30). Then, the processing returns to

step A1 to wait for the reception start timing for the next subframe to the FM radio receiver.

The FM radio receiver of this embodiment is designed to receive the personal ID data group and the information type data group in the subframe assigned to itself. However, the personal ID data group may be inserted in the subframe assigned to the receiver to be paged and the information type data group may be inserted in the subframe commonly assigned to all the receivers (e.g., the data packets included in the packets No. 265 to No. 271 are treated as the common subframe) on the transmission side, while each receiver may intermittently receive the subframe addressed to itself and the common subframe.

In this embodiment, the desired information type ID is selectively registered in advance and, upon reception of the information type ID which matches with the registered information type ID, processing associated with the program with the program number in the selection control data which is affixed with the matched information type ID is executed. Alternatively, the program number of the desired program may be selectively registered in advance, and upon reception of the program number which matches with the registered program number, processing associated with the program with that program number may be executed.

The use of the information type ID as in this embodiment is however advantageous in that re-registration of data in the input data memory 23 is unnecessary every time the type of the program contents is changed, for example, when the type of program contents corresponding to the program number should not necessarily be fixed.

Although the control code for designating the receiver's operation mode is affixed to the head of the selection control data before transmission on the transmission side in the above-described embodiment, a modification may be made to be able to register the receiver's operation mode at the time of registering the information type ID on the reception side as shown in FIG. 24.

The program which accomplishes the individual functions in the flowcharts illustrated in FIGS. 20-22 is stored on the ROM card (recording medium) in the form of program codes readable by the CPU 15.

Although the reception section 12 and the multiplexed information reproducing section 14 are powered off in the intermittent reception mode in the above-described embodiment, the reception section 12 alone or the multiplexed

information reproducing section 14 alone may be powered off.

Although the foregoing description of the embodiment has been given of the case where this invention is adapted to an FM teletext broadcasting system, this invention is not limited to this particular case and may be adapted to any other system which transmits and receives broadcast radio waves like a TV teletext broadcasting system as long as it can receive various kinds of program data.

It should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit or scope of the invention.

In the above-described first embodiment, the FM radio receivers 1a to 1d receive paging data and information type data during subframe periods assigned to the FM radio receivers 1a to 1d. However, the FM broadcasting station 5 may transmit the paging data during a subframe period assigned to the receivers to be paged, and may transmit the information type data during a subframe period assigned in common to all of the FM radio receivers 1a to 1d. Each of those receivers may intermittently receive a subframe of its own and a common subframe. The data packet containing packet Nos. 265 to 271 can be used as the common subframe 16.

A paging system using the FM teletext broadcasting will now be described as another embodiment of the present invention, with reference to the drawings.

The EEPROM 20 stores, as information type IDs, program category names corresponding to program category Nos. shown in FIG. 25A, in addition to data used for performing error correction in the error correcting decoder 142. Furthermore, the EEPROM 20 stores program index names corresponding to program index Nos.

A user can, as he/she desires, select and set program category names and their corresponding program index names such as those shown in FIG. 25A by operating the key input section 18. The program category names and the program index names as set by the user are stored in the input data memory 23.

FIG. 25B shows examples of the program category Nos. and their corresponding program index Nos. which are stored in the input data memory 23. Here, "03", "05" and "06" are selected and set as the program category Nos., while "01", "07" and "08" are selected and set as their program index Nos. corresponding to the program category No."3".

When the value of the identification code MID in segment 3 (paging data) shown in FIG. 13 is "2", information type data group such as that shown in FIG. 26 is

inserted in the common subframe 16.

To be specific, as shown in FIG. 26, the information type data group includes segment identification, the number of segment data bytes, a character type, the number of message data bytes, a common information type code, a program category No., a program index No, a program No., an update flag and a page No.

The segment identification, which consists of 4 bits, defines the contents of the segment data and is set at the value "9" (1001) representing common information. The number of segment data bytes, which consists of 4 bits, represents the number of bytes constituting the segment data. If necessary, the number of extended segment data bytes, which is 1-bite data, can be affixed.

The character type consists of 2 bits and determines the form of the segment data. The value "3" (11) is used as the character type. The number of message data bytes consists of 6 bits and represents the number of bytes constituting all of the information type data following to the common information type code.

The common information type code consists of 1 byte and indicates the type of the common information in order that the common information can be utilized as another type of information in future. In the case of the information type data, the value of the common information type code is "0".

The information type data group has one or more pieces of information type data. The information type data includes a 1-byte program category No., a 1-byte program index No., a 1-byte program No., a 2-bit update flag and a 6-bit page No.

The program category No. indicates a program category, and its content is as shown in FIG. 25A. The program index No. represents one of indexes corresponding to the category, and its content is as shown in FIG. 25A.

The program No. represents the number assigned to a program for broadcasting information of the type indicated by the program category No. and the program index No. The update flag is incremented when the information type data is updated. The page No. designates a page number in the case of the continuous reception of data. However, the page No. does not designate a page number when it represents the maximum value "63", and has the same content as that in the prefix.

As shown in FIGS. 17, 18A and 18B, the program management data includes the program data header, which is the data header of the program management data, and the data unit group. The program data to which information having the format shown in FIG. 27 has been affixed as the data unit data, is

transmitted.

As shown in FIG. 27, the data unit data includes a 4-bit ID code whose value, i.e. "2" (0010) is fixed, the number of data unit data bytes which is 4-bit data, a 1-byte category index update flag, a 1-byte program category No., a 1-byte index No., 4-bit data whose value, i.e. "0" (0000) is fixed, 4-bit data representing the type of the service undertaken by the service center, a service center reception box No. (the upper 1 byte and the lower 1 byte), 1-byte transmission form type data and a 2-byte search index. Actual program data is transmitted subsequent to the search index.

The number of data unit data bytes represents the length of the data subsequent thereto. The category index update flag is incremented by 1 when the data unit data is updated. The update flag represents one of the values "00h" to "ffh".

The program category No. indicates a program category such as that shown in FIG. 25A. Program category No. "00" indicates a list of programs. Program category No. "01" indicates a program for broadcasting a set sentence. Program category No. "02" indicates a record reception menu. In the case of broadcasting the list of programs, the set sentence broadcasting program and the record reception menu during the same period of time, different program Nos. are assigned to the list of programs, the set sentence broadcasting program and the record reception menu.

The type of the service undertaken by the service center represents the service ID No. required to access the service center through a telephone line. When the value of the service ID No. is "1010", the service center offers a "message board" service. When the value of the service ID No. is "1011", the service center offers a "program request" service.

When a user accesses the service center through a telephone line and send a reply to a program through his/her receiver, the reply is transmitted to that box in a service center's computer which is designated by the service center reception box No. The service center reception box No. consists of 2 bytes and represents one of the values "0" to "4096".

The transmission form type data represents one of the values "0" to "127", and its lower seven bits indicate the type of a transmission form. When the uppermost bit of the transmission form type data represents "1", this indicates that each FM radio receiver enters into a code No. input mode at the time the data transmission is finished. When the uppermost bit of the transmission form type data represents "0", this indicates that each FM radio receiver is not in the code No. input

mode.

The search index indicates whether a search for each of items b1 to b16 (e.g. the name of a place and price) can be performed or not. When the value of the search index is "1", the search can be performed. When the value of the search index is "0", the search cannot be performed.

Operations according to this embodiment will now be described.

In the case where one listens to an ordinary FM radio broadcast program by any of the FM radio receivers 1b-1d, a control line B is rendered active to set on the switches 123 and 134 in response to an instruction given from the CPU 15 in association with the key operation of the key input section 18. As a result, the reception section 12 and the audio information reproducing section 13 are powered on.

When FM broadcast radio waves are received at the antenna 11 under this situation, they are tuned by the FM tuner 121 and then demodulated by the FM demodulator 122. A stereo audio signal (L+R signal and L-R signal), which is the demodulated signal from the FM demodulator 122, is separated into an L signal and an R signal by the stereo demodulator 131 and audio sounds corresponding to the separated L signal and R signal are output via the respective amplifiers 132 and 133 from the speakers 135 and 136.

In the case where one wants to listen to an ordinary FM radio broadcast program and watch an FM teletext broadcast program using any of the FM radio receivers 1b-1d, a control line A is rendered active to set on the switches 123, 134 and 144 in response to an instruction given from the CPU 15 in association with the key operation of the key input section 18. As a result, the reception section 12, the audio information reproducing section 13 and the multiplexed information reproducing section 14 are all powered on.

In this case, while the aforementioned reception of audio information is performed, the L-MSK demodulator 141 separates and demodulates the multiplexed signal, which is then subjected to error correction in the error correction decoder 142, and the resultant signal is displayed as character information on the display section 17 in accordance with an instruction from the CPU 15.

In the case where one wants to watch an FM teletext broadcast program, a control line C is rendered active to set on the switches 123 and 144. As a result, the reception section 12 and the multiplexed information reproducing section 14 are powered on. When the intermittent reception mode is designated, the CPU 15 sends

a battery saving signal onto the control line C.

When the user previously registers the information type ID of information to be stored in the FM radio receiver 1, first, the user should operate a predetermined key on the key input section 18 to display a table which indicates any of the information type IDs, that is, program category No. and names, and program index No. and names as shown in FIG. 25A, on the display section 17. Then, the user should operate a predetermined key on the key input section 18 to select a desired No. from the program category No. and the program index No. displayed on the display section 17. As a result, the selected program category No. and program index No. are stored in the input data memory 23 as the information type ID.

Each FM radio receiver 1a, 1b, 1c, or 1d belongs to any one of sixteen groups separated based on the data of the lower four bits in its own ID code. Each FM radio receiver 1a, 1b, 1c, or 1d is designed to be able to intermittently receive the subframes that correspond to the group to which this FM radio receiver substantially belongs and the common subframes.

When the intermittent reception mode is designated, the FM radio receiver 1 first waits for the timing to start receiving its subframe (step C1). When the reception start timing for the subframe to the FM radio receiver has come in step C1, the reception section 12 and the multiplexed information reproducing section 14 are powered on in response to an instruction given from the CPU 15 (step C9).

When it is determined in step C10 that the reception end timing for that subframe has not arrived yet, it is determined if the 4-bit service ID code in the prefix shown in FIG. 9B in a data packet constituting this subframe is for paging information (step C12). This determination is performed repeatedly.

When it is determined in step C10 that the reception end timing for the subframe has arrived, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step C11). The processing returns to step C1 to wait for the reception start timing for the subframe to the FM radio receiver.

In this case, as shown in FIG. 32B, those sections are powered on at the reception start timing of its subframe in one frame, e.g., a subframe 7, shown in FIG. 32A. When the service ID code of the subframe is not for paging information (intermittence reception), the reception section 12 and the multiplexed information reproducing section 14 are powered off at the reception end timing for its subframe.

If the FM broadcasting station always inserts paging information in a data packet at the head of each subframe before transmission, each of the FM radio receivers 1a-1d can power off the reception section 12 and the multiplexed information reproducing section 14 when determining that the service ID code in the data packet at the head of the subframe is not for paging information.

When it is determined in step C12 that the service ID code for the paging information is detected in the subframe, a reference is immediately made to the paging data shown in FIG. 10 and included in the data packet constituting the subframe, and it is determined whether the ID group identification flag in the paging information shown in FIG. 13 coincides with the flag assigned to the FM radio receiver (step C13).

When it is not determined that the ID group identification flag does not coincide with the flag assigned to the FM radio receiver, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step C14). The processing then returns to step C1 to wait for the reception start timing for the subframe to the FM radio receiver.

In short, if the ID group identification flag does not coincide with the flag assigned to the FM radio receiver, the reception section 12 and the multiplexed information reproducing section 14 are powered off immediately.

When it is determined in step C13 that the ID group identification flag coincides with the flag assigned to the FM radio receiver, the first to N-th paging IDs with no message and the first to M-th paging IDs with a message in the paging information shown in FIG. 13 are searched for the paging ID of the FM radio receiver (step C15).

It is then determined if its own paging ID has been detected in the search in step C15 (step C16). When it is determined in step C16 that its paging ID has not been detected, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step C17). The processing then returns to step C1 to wait for the reception start timing for the subframe to the FM radio receiver.

When it is determined in step C16 that its paging ID has been detected, it is determined if this paging ID is accompanied with a message (step C18). When it is determined in step C18 that the paging ID is accompanied with no message, the

control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step C19). Then, the alerting section 16 is activated in response to an instruction from the CPU 15 to start informing the user of the FM radio receiver 1a, 1b, 1c, or 1d being paged (step C20). The processing then returns to step C1 to wait for the reception start timing for the subframe to the FM radio receiver.

When it is determined in step C18 that the paging ID is accompanied with a message, the paging information shown in FIG. 13 is searched for a message addressed to the FM radio receiver (step C21). Then, the searched message is stored in the reception data memory 21 (step C22). Next, the control line C is rendered inactive to power off the reception section 12 and the multiplexed information reproducing section 14 in response to an instruction from the CPU 15 (step C23). Then, the alerting section 16 is activated in response to an instruction from the CPU 15 to start informing the user of the FM radio receiver 1a, 1b, 1c, or 1d being paged (step C24). The processing then returns to step C1 to wait for the reception start timing for the subframe to the FM radio receiver.

The processing in steps C9 to C24 is performed when it is determined in step C1 that it is the time for each of the FM radio receivers 1a to 1d to start receiving its own subframe. When it is determined in step C1 that it is not the time to start receiving its own subframe, then it is determined whether the program category No. and the index No. have been selected and set in the input data memory 23 as the information type ID (step C2).

When it is determined that the program category No. and the index No. have been selected and set in the input data memory 23, each of the FM radio receivers 1a to 1d waits the time to start receiving the common subframe (step C3). At the point it is determined in step C3 that it is the time to start receiving the common subframe, the CPU 15 makes the control line C active, and turns on the receiving section 12 and the multiplexed information reproducing section 14 (step C4).

After that, it is determined whether it is the time to finish receiving the common subframe (step C5). When it is determined in step C5 that it is not the time to finish receiving the common subframe, it is determined whether the 4-bit service identification code in the prefix, shown in FIG. 9B, of the received data packet forming the above subframe is a service identification code for the intermittent reception (step C6).

When it is determined that the 4-bit service identification code is not for the intermittent reception, the processing returns to step C5. When it is determined that the 4-bit service identification code is for the intermittent reception, then it is determined whether the value of the segment identification at the head of the data block is "9" as shown in FIG. 26 (step C7).

When it is determined that the value of the segment identification is not "9", the processing returns to step C5. When the value of the segment identification is "9", it is determined whether the value of the common information type code is "0" (step C8).

When it is determined that the value of the common information type code is not "0", the processing returns to step C5. At the point it is determined in step C5 that it is the time to finish receiving the common subframe, the CPU 15 makes the control line C inactive, and turns off the receiving section 12 and the multiplexed information reproducing section 14. Then, the processing returns to step C1, and each of the FM radio receivers 1a to 1d waits the time to start receiving the next subframe of its own.

In this case, the receiving section 12 and the multiplexed information reproducing section 14 are turned on as shown in FIG. 32b at the timing at which the common subframe 16 in 1 frame shown in FIG. 32a begins. When the service identification code for the common information is not detected in the subframe 16, the receiving section 12 and the multiplexed information reproducing section 14 are turned off at the timing at which the common subframe 16 ends.

When it is determined in step C8 that the value of the common information type code is "0", the valuable n representing the program category No. is set at the initial value "1" (step C25). Next, the n-th program category No. received with the information type data in the common subframe 16, and the program category No. set in the input data memory 23 are compared with each other (step C26). Based on the result of the comparison in step C26, it is determined whether both category Nos. coincide with each other, i.e., whether the program to be received is being broadcast (step C27).

When it is determined in step C27 that both program category Nos. do not coincide with each other, determination is performed as to whether a comparison between the received n-th program category No. and all program category Nos. set in the input data memory 23 has been finished (step C33). When it is determined in

step C33 that the comparison between the received n-th program category No. and all program category Nos. set in the input data memory 23 has not been finished, the processing returns to step C26. When it is determined in step C33 that the comparison between the received n-th program category No. and all program category Nos. set in the input data memory 23 has been finished, then it is determined whether a comparison between the program category Nos. set in the input data memory 23 and all of the received program category Nos. has been finished (step C34).

When it is determined that the comparison between the program category Nos. set in the input data memory 23 and all of the received program category Nos. has not been finished, the value of the valuable n is incremented by 1 (step C35), and the processing returns to step C26.

When it is determined in step C27 that the program category Nos. coincide with each other, it is determined whether their corresponding program index Nos. have been set in the input data memory 23 (step C28).

When it is determined in step C28 that the corresponding program index Nos. have been set in the input data memory 23, those program index Nos. are compared with the program index No. received subsequent to the program category No. (step C29), and it is determined whether there is a coincidence between the corresponding program index Nos. set in the input data memory 23 and the received program index No. (step C30).

When it is determined in step C30 that there is no coincidence between the corresponding program index Nos. set in the input data memory 23 and received program index No., determination is further performed as to whether all program index Nos. set in correspondence with the program category No. have been compared with the received program index No. (step C36). When it is determined in step C36 that all of them have not been compared with the received program index No., the processing returns to step C29.

When it is determined in step C30 that there is a correspondence between the corresponding program index Nos. set in the input data memory 23 and the received program index No., or when it is determined that such corresponding program index Nos. have not been set in the input data memory 23, a reference is made to the update flag in the received program data, and it is determined whether the same program data has already been received and stored in the reception data memory 21

(step C31).

When it is determined in step C31 that the same program data has not yet been received or stored in the reception data memory 21, the program No. and the page No. of the received information type data are stored in the reception data memory 21 as the selection control data for use in the reception of a program (step C32), and the processing advances to step C34.

The processing goes to step C34 also when it is determined in step C36 that all program index Nos. set in correspondence with the program category No. have been compared with the received program index No.

When it is determined in step C34 that a comparison between the program category Nos. set in the input data memory 23 and all of the received program category Nos. has been finished, the processing advances to C37 so as to be executed based on the selection control data which is stored in the reception data memory 21.

In step C37, it is determined whether the selection control data has been stored in the reception data memory 21. When it is determined in step C37 that the selection control data has not been stored, the CPU 15 makes the control line C inactive, and turns off the receiving section 12 and the multiplexed information reproducing section 14 (step C38). The processing returns to step C1, and each of the FM radio receivers 1a to 1d waits the time to start receiving the next subframe of its own.

When it is determined in step C37 that the selection control data has been stored in the reception data memory 21, the intermittent reception mode is shifted to a continuous reception mode (step C39), and the processing advances to step C40. In step C40, it is determined whether the program data designated by the program No. in the selection control data stored in the reception data memory 21 has been received. When it is determined in step C 40 that the program data designated by the program No. in the selection control data has been received, it is determined whether the selection control data designates a page No. (step C42).

When it is determined in step C 42 that the selection control data designates a page No., the reception of the program data of the designated page No. and the storing of that program data into the reception data memory 21 are started (step C43). When it is determined in step C42 that the selection control data designates no page No., the reception of the designated program data and the storing

of that program data into the reception data memory 21 are started irrespective of a page No (step C44).

When it is determined in step C40 that the program data designated by the selection control data has not been received, determination is performed based on the information type data received with the common subframe 16 as regards whether the broadcasting of the program data designated by the selection control data has ended (step C41). When it is determined in step C41 that the broadcasting of the program data designated by the selection control data has not ended, the processing returns to step C40.

In step C43 or C44, the reception and storage of the designated program data are started, after which it is determined whether the reception and storage of that program data have been finished (step C45). When it is determined in step C45 that the reception and storage of the program data have not been finished, determination is performed based on the information type data received with the common subframe 16 as regards whether the broadcasting of the program data designated by the selection control data has ended (step C46). Until it is determined in step C46 that the broadcasting of the designated program has ended, steps C45 and C46 are repeated, and the reception and storage of the program data are continued.

When it is determined in step C45 that the reception and storage of the program data have been finished, or when it is determined in step C46 that the broadcasting of the designated program data has ended, or when it is determined in step C41 that the broadcasting of the designated program data has ended, the selection control data stored in the reception data memory 21 is deleted (step C47), the continuous reception mode is reverted to the intermittent reception mode (step C48). The processing goes to step C1 again, and each of the FM radio receivers 1a to 1d waits the time to start the next subframe of its own.

In the case where a plurality of selection control data items are stored in the reception data memory 21, steps C40 to C46 are executed based on the respective selection control data items. At the point the reception and storage of all program data items designated by the respective selection control data items are finished, the processing advances to step C47.

As seen from steps C41 and C46, in the case where the broadcasting of the program data desired has ended during the reception or storage of that program data, the continuous reception mode is canceled to return to the intermittent reception

mode. This prevents wasteful consumption of the power of the batteries in the FM radio receivers 1a to 1d.

In this embodiment, the program No. and the page No. are set as the information type data. In the case where the page No. are set thus, only the information of the page is received and stored. This ensures only the required information being stored in the reception data memory 21 so that the reception data memory 21 can be used with efficiency.

CLAIMS

1. A broadcasting apparatus for broadcasting plural types of program information, comprising:

first broadcasting means for broadcasting said plural types of program information; and

second broadcasting means for broadcasting information type data indicating a type of on-the-air program information among said plural types of program information.

2. The broadcasting apparatus according to claim 1, wherein said second broadcasting means broadcasts said information type data for predetermined periods previously assigned to a broadcast receiving apparatus for receiving said program information.

3. The broadcasting apparatus according to claim 1, wherein said second broadcasting means broadcasts said information type data and paging identification data of a broadcast receiving apparatus to be paged for predetermined periods previously assigned to said broadcast receiving apparatus to be paged.

4. The broadcasting apparatus according to claim 1, wherein said second broadcasting means broadcasts said information type data and process designation data for designating a process to be executed by a broadcast receiving apparatus for receiving said information type data when received information type data is what is desired by a user.

5. The broadcasting apparatus according to claim 4, wherein said process designation data designates a process of informing said user that program information associated with an information type desired by said user is on the air.

6. The broadcasting apparatus according to claim 4, wherein said process designation data designates a process of displaying program information associated with an information type desired by said user.

7. The broadcasting apparatus according to claim 4, wherein said process designation data designates a process of storing program information associated with an information type desired by said user.

8. The broadcasting apparatus according to claim 1, wherein said second broadcasting means broadcasts said information type data and program identification data indicating a program carrying information of a type indicated by said information type data.

9. The broadcasting apparatus according to claim 1, wherein said first and second broadcasting means broadcast said program information and said information type data, multiplexed on FM broadcast radio waves.

10. A broadcasting apparatus for broadcasting a plurality of programs, comprising:

first broadcasting means for broadcasting said a plurality of programs; and

second broadcasting means for broadcasting program identification data indicating an on-the-air program among said plurality of programs to be broadcast for predetermined periods previously assigned to a broadcast receiving apparatus for receiving said program information.

11. A transmitting apparatus for transmitting plural types of information, comprising:

first transmitting means for transmitting said plural types of information; and

second transmitting means for transmitting information type data indicating a type of information which is being transmitted among said plural types of information.

12. A broadcast receiving apparatus for receiving and displaying plural types of program information broadcast, comprising:

receiving means for receiving first information type data indicating an information type of on-the-air program information among said plural types of broadcast program information;

information type data setting means for setting second information type data;

comparison means for comparing said first information type data received by said receiving means with said second information type data set by said information type data setting means; and

control means for, when comparison by said comparison means results in a match, executing a process for program information associated with said matched information type data.

13. The broadcast receiving apparatus according to claim 12, wherein said receiving means receiving said first information type data by intermittent reception for performing reception for predetermined periods previously assigned to said broadcast receiving apparatus.

14. The broadcast receiving apparatus according to claim 12, wherein said receiving means receives said first information type data and paging identification data by intermittent reception for performing reception for predetermined periods previously assigned to said broadcast receiving apparatus; and

further comprising:

discrimination means for discriminating whether or not said paging identification data received by said receiving means is paging identification data of said broadcast receiving apparatus; and

paging informing means for informing paging when said paging identification data is discriminated to be paging identification data of said broadcast receiving apparatus by said discrimination means.

15. The broadcast receiving apparatus according to claim 12, further comprising informing means for executing a process of informing that program information associated with said matched information type data is on the air; and

wherein said control means causes said informing means to execute said informing process.

16. The broadcast receiving apparatus according to claim 12, further comprising display means for displaying program information associated with said matched information type data; and

wherein said control means causes said display means to display said program information.

17. The broadcast receiving apparatus according to claim 12, further comprising storage means for storing program information associated with said matched information type data; and

wherein said control means causes said storage means to store said program information.

18. The broadcast receiving apparatus according to claim 13, further comprising display means for displaying program information associated with said matched information type data; and

wherein said control means causes said display means to display said program information after causing said receiving means to release said intermittent reception.

19. The broadcast receiving apparatus according to claim 18, wherein said control means causes said receiving means to execute intermittent reception after

causing said display means to display said program information.

20. The broadcast receiving apparatus according to claim 13, further comprising storage means for storing program information associated with said matched information type data; and

wherein said control means causes said storage means to store said program information after causing said receiving means to release said intermittent reception.

21. The broadcast receiving apparatus according to claim 20, wherein said control means causes said receiving means to execute intermittent reception after causing said storage means to store said program information.

22. The broadcast receiving apparatus according to claim 12, wherein said receiving means receives said first information type data and designation data for designating a process to be executed by said control means; and

said control means executes a process for program information associated with said matched information type data in accordance with said designation data received by said receiving means.

23. The broadcast receiving apparatus according to claim 12, wherein said receiving means receives said first information type data and program identification data indicating a program carrying information of a type indicated by said first information type data; and

said control means executes a process for program information according to said matched information type data and said program identification data received by said receiving means.

24. The broadcast receiving apparatus according to claim 12, further comprising designation data setting means for setting designation data for designating a process to be executed by said control means; and

wherein said control means executes a process for program information associated with said matched information type data in accordance with said designation data set by said designation data setting means.

25. The broadcast receiving apparatus according to claim 12, wherein said receiving means receives said program information and said first information type data, multiplexed on FM broadcast radio waves.

26. A broadcast receiving apparatus for receiving and displaying plural types of program information broadcast, comprising:

receiving means for receiving first program identification data indicating on-the-air program information among said plural types of broadcast program information by intermittent reception for performing reception for predetermined periods previously assigned to said broadcast receiving apparatus;

program identification data setting means for setting second program identification data;

comparison means for comparing said first program identification data received by said receiving means with said second program identification data set by said program identification data setting means; and

control means for, when comparison by said comparison means results in a match, executing a process for program information according to said matched program identification data.

27. A receiving apparatus for receiving and displaying plural types of information transmitted, comprising:

receiving means for receiving first information type data indicating a type of information which is being transmitted among said plural types of transmitted information;

information type data setting means for setting second information type data;

comparison means for comparing said first information type data received by said receiving means with said second information type data set by said information type data setting means; and

control means for, when comparison by said comparison means results in a match, executing a process for program information associated with said matched information type data.

28. A broadcasting system comprising a broadcasting apparatus for broadcasting plural types of program information and broadcast receiving apparatuses for receiving and displaying program information broadcast from said broadcasting apparatus,

said broadcasting apparatus including:

first broadcasting means for broadcasting said plural types of program information; and

second broadcasting means for broadcasting first information type data indicating a type of on-the-air program information among said plural types of

program information to be broadcast,

each of said broadcast receiving apparatuses including:

receiving means for receiving said plural types of program information and said first information type data, respectively broadcast by said first broadcasting means and said second broadcasting means;

information type data setting means for setting second information type data;

comparison means for comparing said first information type data received by said receiving means with said second information type data set by said information type data setting means; and

control means for, when comparison by said comparison means results in a match, executing a process for program information associated with said matched information type data.

29. A broadcasting system comprising a broadcasting apparatus for broadcasting a plurality of programs and broadcast receiving apparatuses for receiving and displaying the programs broadcast from said broadcasting apparatus,

said broadcasting apparatus including:

first broadcasting means for broadcasting said plurality of programs; and

second broadcasting means for broadcasting first program identification data indicating an on-the-air program among said plurality of programs to be broadcast for predetermined periods previously assigned to said broadcast receiving apparatuses for receiving said on-the-air program,

each of said broadcast receiving apparatuses including:

receiving means for receiving said first program identification data broadcast by said second broadcasting means by intermittent reception for performing reception for predetermined periods previously assigned to said each broadcast receiving apparatus;

program identification data setting means for setting second program identification data;

comparison means for comparing said first program identification data received by said receiving means with said second program identification data set by said program identification data setting means; and

control means for, when comparison by said comparison means results in a match, executing a process for a program according to said matched program

identification data.

30. A transmitting and receiving system comprising a transmitting apparatus for transmitting plural types of information and receiving apparatuses for receiving and displaying information transmitted from said transmitting apparatus,

said transmitting apparatus including:

first transmitting means for transmitting said plural types of information; and

second transmitting means for transmitting first information type data indicating a type of information which is being transmitted among said plural types of information,

each of said receiving apparatuses including:

receiving means for receiving said plural types of information and said first information type data, respectively transmitted by said first transmitting means and said second transmitting means;

information type data setting means for setting second information type data;

comparison means for comparing said first information type data received by said receiving means with said second information type data set by said information type data setting means; and

control means for, when comparison by said comparison means results in a match, executing a process for program information associated with said matched information type data.

31. A broadcasting method comprising:

a first step of broadcasting plural types of program information; and

a second step of broadcasting information type data indicating a type of on-the-air program information among said plural types of program information.

32. A broadcasting method comprising:

a first step of broadcasting a plurality of programs; and

a second step of broadcasting program identification data indicating an on-the-air program among said plurality of programs to be broadcast for predetermined periods previously assigned to a broadcast receiving apparatus for receiving said program information.

33. A transmitting method comprising:

a first step of transmitting plural types of information; and

a second step of transmitting information type data indicating a type of information which is being transmitted among said plural types of information.

34. A broadcast receiving method comprising:

a step of receiving first information type data indicating an information type of on-the-air program information among plural types of broadcast program information;

a step of setting second information type data;

a step of comparing said received first information type data with said set second information type data; and

a step of, when comparison results in a match, executing a process for program information associated with said matched information type data.

35. A broadcast receiving method comprising:

a step of receiving first program identification data indicating on-the-air program information among plural types of broadcast program information by intermittent reception for performing reception for predetermined periods previously assigned to a broadcast receiving apparatus in question;

a step of setting second program identification data;

a step of comparing said received first program identification data with said set second program identification data; and

a step of, when comparison results in a match, executing a process for program information according to said matched program identification data.

36. A receiving method comprising:

a step of receiving first information type data indicating a type of information which is being transmitted among plural types of transmitted information;

a step of setting second information type data;

a step of comparing said received first information type data with said set second information type data; and

a step of, when comparison results in a match, executing a process for information associated with said matched information type data.

FIG.1

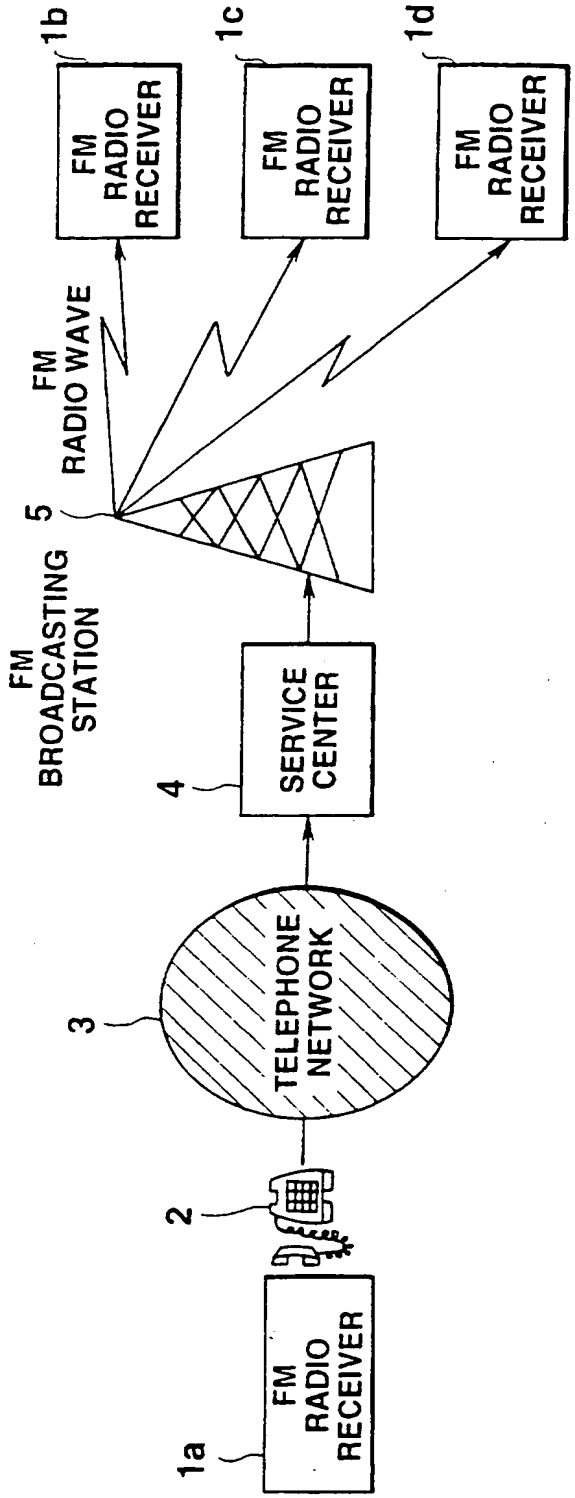

1a
FM RADIO RECEIVER
2
3
TELEPHONE NETWORK
4
SERVICE CENTER
FM BROADCASTING STATION
5
FM RADIO WAVE
1b
FM RADIO RECEIVER
1c
FM RADIO RECEIVER
1d
FM RADIO RECEIVER

FIG.2

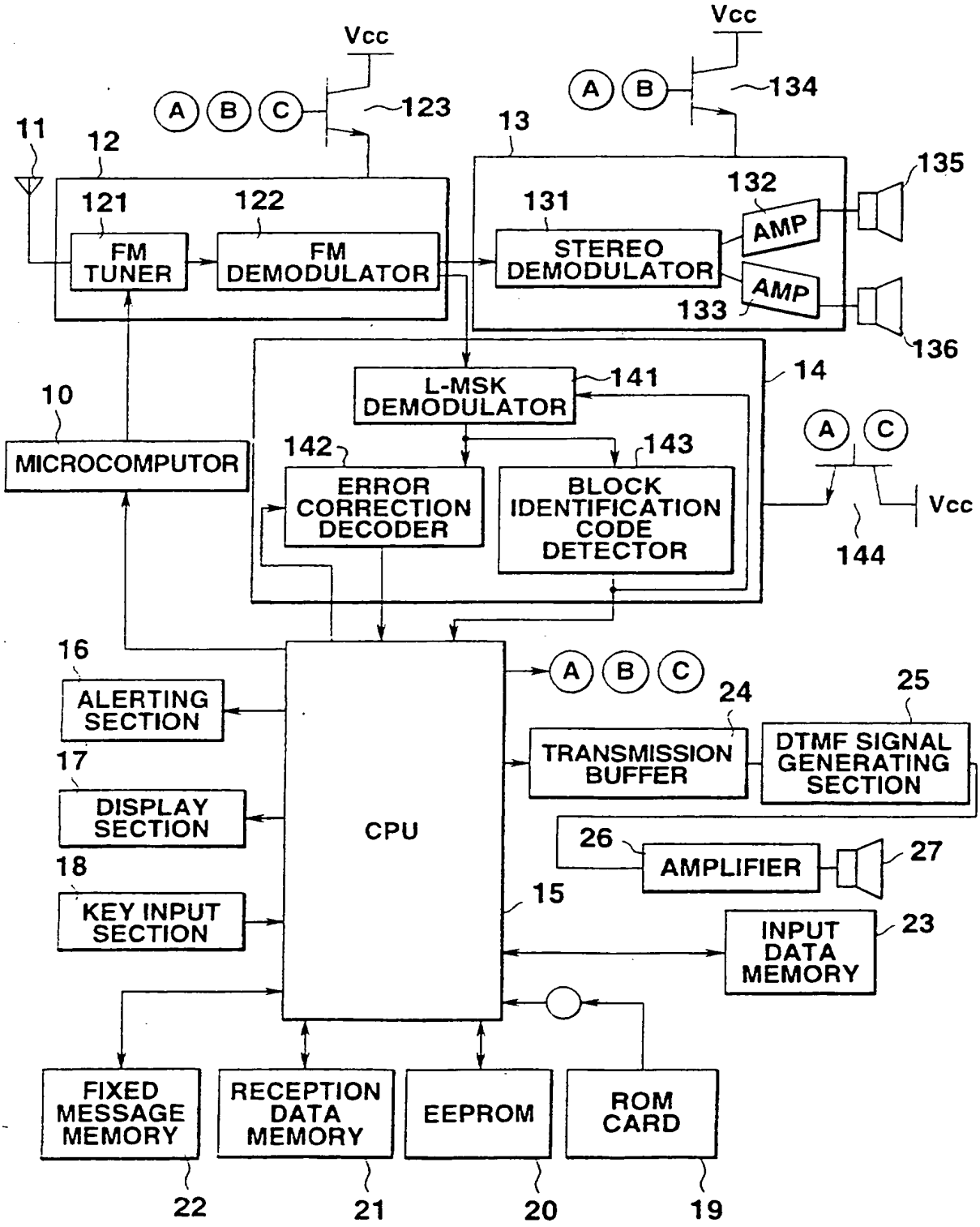

Vcc
A B C
123
11
12
121
122
FM TUNER
FM DEMODULATOR
13
Vcc
A B
134
131
132
AMP
135
STEREO DEMODULATOR
AMP
133
136
14
L-MSK DEMODULATOR
141
10
MICROCOMPUTOR
142
143
ERROR CORRECTION DECODER
BLOCK IDENTIFICATION CODE DETECTOR
A C
Vcc
144
16
ALERTING SECTION
17
DISPLAY SECTION
18
KEY INPUT SECTION
CPU
A B C
24
TRANSMISSION BUFFER
25
DTMF SIGNAL GENERATING SECTION
26
AMPLIFIER
27
15
INPUT DATA MEMORY
23
FIXED MESSAGE MEMORY
RECEPTION DATA MEMORY
EEPROM
ROM CARD
22
21
20
19

FIG.3

20

INFORMATION TYPE ID	CONTENTS
0	ROCK INFORMATION
1	POPS INFORMATION
2	STOCK INFORMATION
3	CONCERT RESERVATION INFORMATION
⋮	⋮

FIG.4

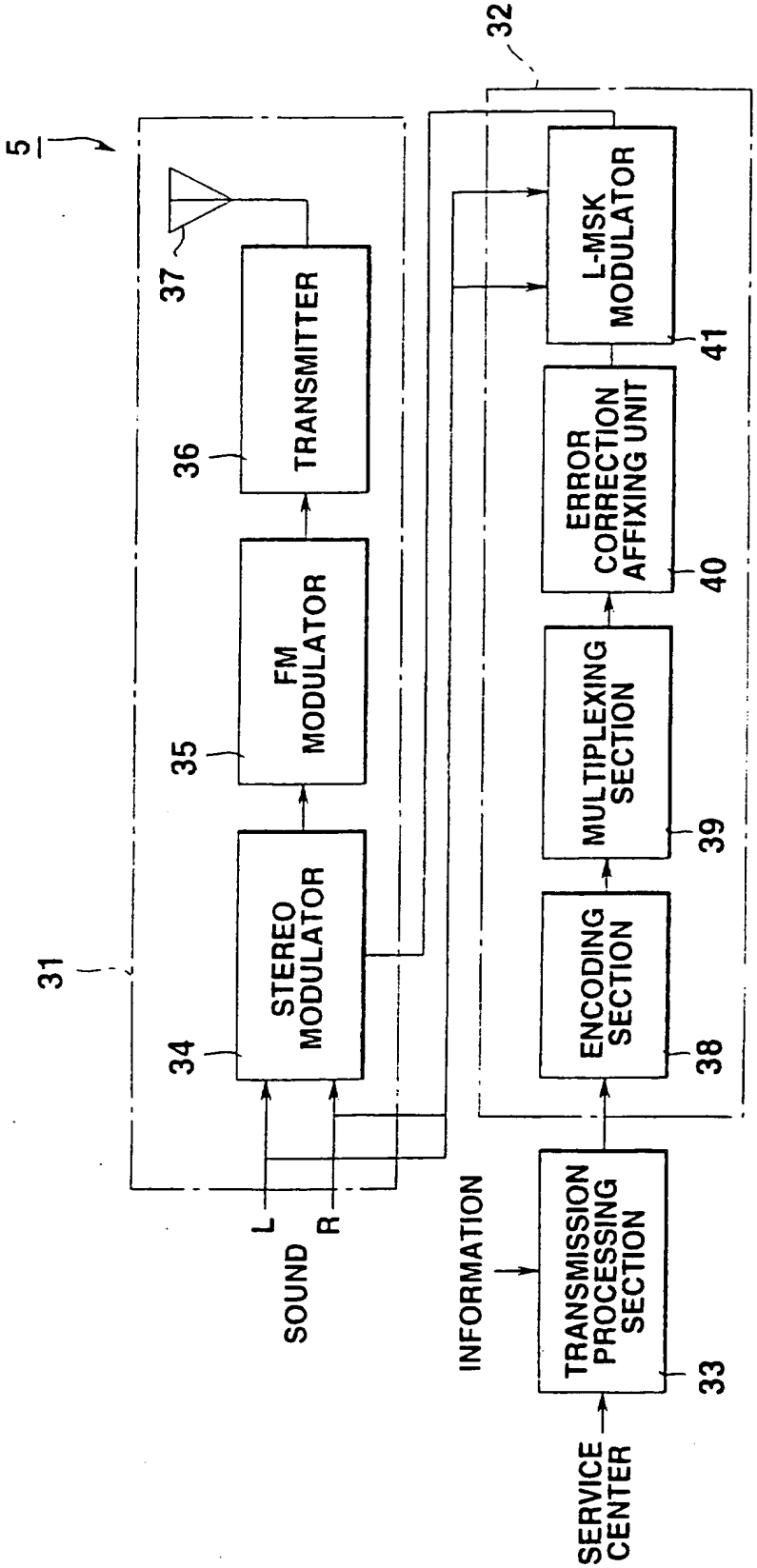

5
31
32
37
36
TRANSMITTER
35
FM MODULATOR
34
STEREO MODULATOR
L
R
SOUND
INFORMATION
TRANSMISSION PROCESSING SECTION
33
SERVICE CENTER
ENCODING SECTION
38
MULTIPLEXING SECTION
39
ERROR CORRECTION AFFIXING UNIT
40
L-MSK MODULATOR
41

FIG.5

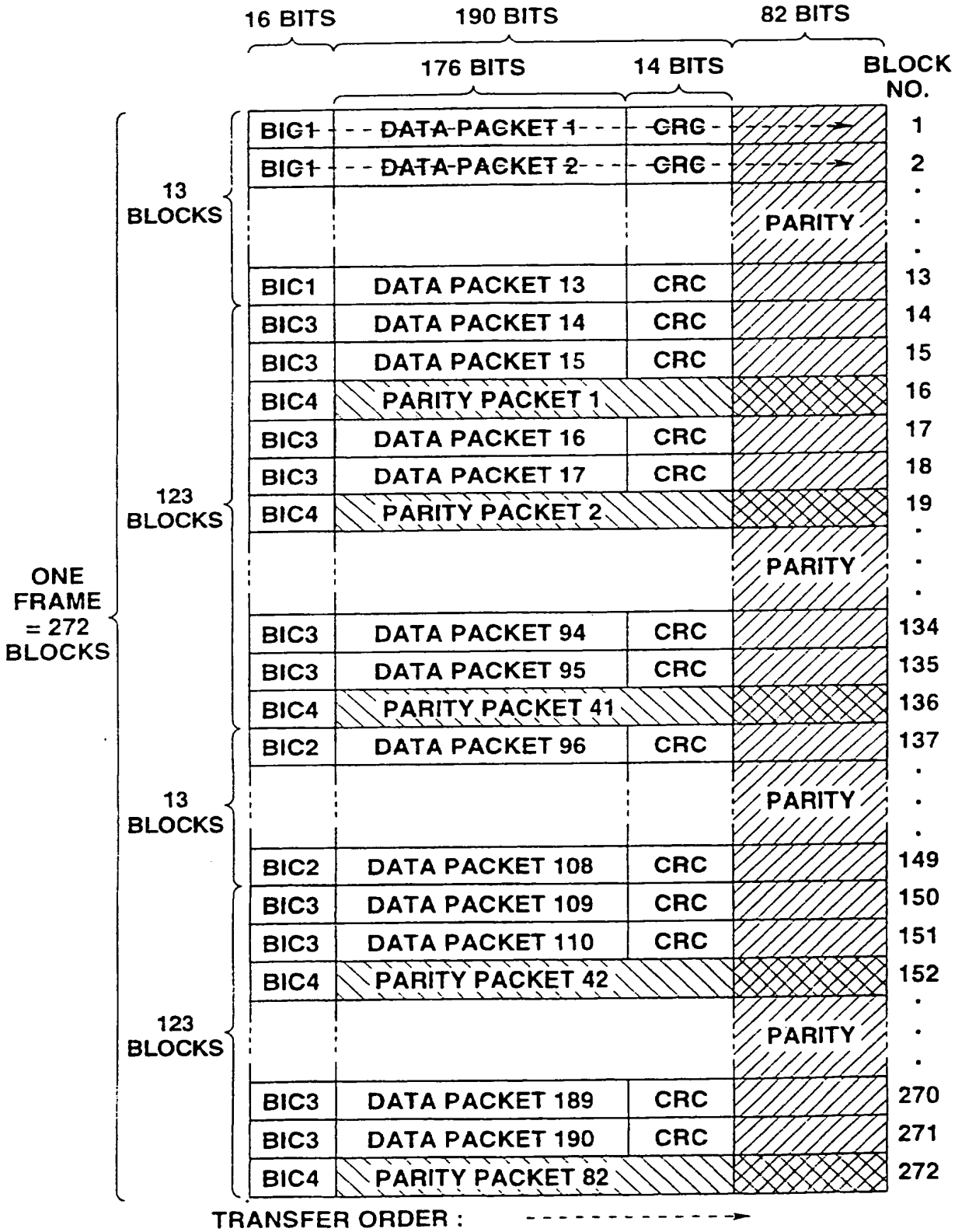

16 BITS
190 BITS
82 BITS
176 BITS
14 BITS
BLOCK NO.
ONE FRAME = 272 BLOCKS
13 BLOCKS
123 BLOCKS
13 BLOCKS
123 BLOCKS
BIC1 DATA PACKET 1 CRC 1
BIC1 DATA PACKET 2 CRC 2
PARITY
BIC1 DATA PACKET 13 CRC 13
BIC3 DATA PACKET 14 CRC 14
BIC3 DATA PACKET 15 CRC 15
BIC4 PARITY PACKET 1 16
BIC3 DATA PACKET 16 CRC 17
BIC3 DATA PACKET 17 CRC 18
BIC4 PARITY PACKET 2 19
PARITY
BIC3 DATA PACKET 94 CRC 134
BIC3 DATA PACKET 95 CRC 135
BIC4 PARITY PACKET 41 136
BIC2 DATA PACKET 96 CRC 137
PARITY
BIC2 DATA PACKET 108 CRC 149
BIC3 DATA PACKET 109 CRC 150
BIC3 DATA PACKET 110 CRC 151
BIC4 PARITY PACKET 42 152
PARITY
BIC3 DATA PACKET 189 CRC 270
BIC3 DATA PACKET 190 CRC 271
BIC4 PARITY PACKET 82 272
TRANSFER ORDER :

FIG.6

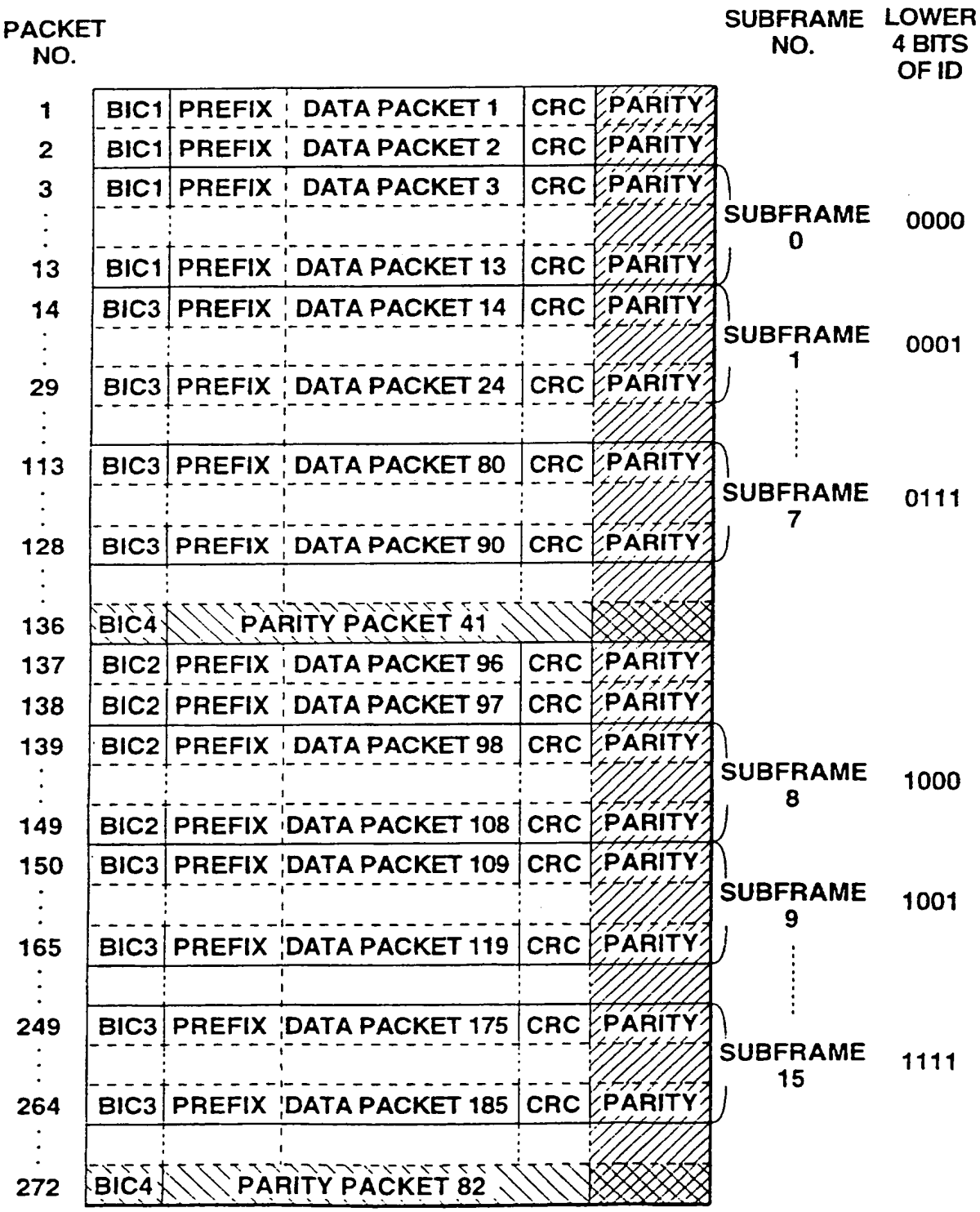

PACKET NO.
SUBFRAME NO.
LOWER 4 BITS OF ID
1 BIC1 PREFIX DATA PACKET 1 CRC PARITY
2 BIC1 PREFIX DATA PACKET 2 CRC PARITY
3 BIC1 PREFIX DATA PACKET 3 CRC PARITY
13 BIC1 PREFIX DATA PACKET 13 CRC PARITY
SUBFRAME 0
0000
14 BIC3 PREFIX DATA PACKET 14 CRC PARITY
29 BIC3 PREFIX DATA PACKET 24 CRC PARITY
SUBFRAME 1
0001
113 BIC3 PREFIX DATA PACKET 80 CRC PARITY
128 BIC3 PREFIX DATA PACKET 90 CRC PARITY
SUBFRAME 7
0111
136 BIC4 PARITY PACKET 41
137 BIC2 PREFIX DATA PACKET 96 CRC PARITY
138 BIC2 PREFIX DATA PACKET 97 CRC PARITY
139 BIC2 PREFIX DATA PACKET 98 CRC PARITY
149 BIC2 PREFIX DATA PACKET 108 CRC PARITY
SUBFRAME 8
1000
150 BIC3 PREFIX DATA PACKET 109 CRC PARITY
165 BIC3 PREFIX DATA PACKET 119 CRC PARITY
SUBFRAME 9
1001
249 BIC3 PREFIX DATA PACKET 175 CRC PARITY
264 BIC3 PREFIX DATA PACKET 185 CRC PARITY
SUBFRAME 15
1111
272 BIC4 PARITY PACKET 82

FIG.7

RELATION BETWEEN SUBFRAME NO. AND PACKET NO.

SUBFRAME NO.	LOWER 4 BITS OF ID	PACKET NO.	NUMBER OF DATA PACKETS
0	0 0 0 0	3 ~ 13	11
1	0 0 0 1	14 ~ 29	11
2	0 0 1 0	30 ~ 45	11
3	0 0 1 1	47 ~ 62	11
4	0 1 0 0	63 ~ 78	11
5	0 1 0 1	80 ~ 95	11
6	0 1 1 0	96 ~ 111	11
7	0 1 1 1	113 ~ 128	11
8	1 0 0 0	139 ~ 149	11
9	1 0 0 1	150 ~ 165	11
10	1 0 1 0	166 ~ 181	11
11	1 0 1 1	183 ~ 198	11
12	1 1 0 0	199 ~ 214	11
13	1 1 0 1	216 ~ 231	11
14	1 1 1 0	232 ~ 247	11
15	1 1 1 1	249 ~ 264	11

FIG.8

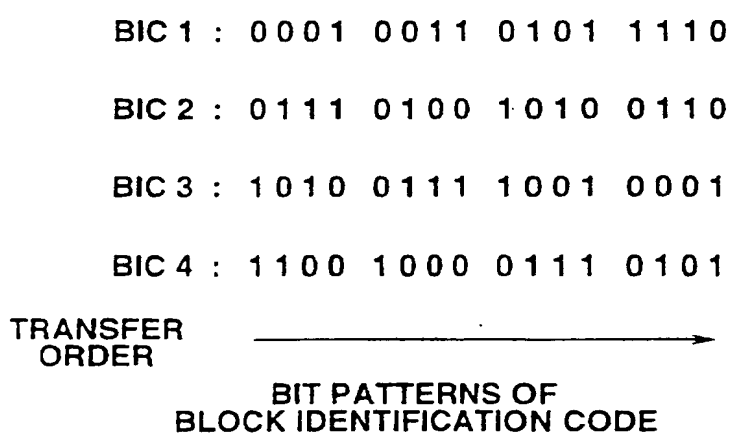

BIC 1 : 0001 0011 0101 1110
BIC 2 : 0111 0100 1010 0110
BIC 3 : 1010 0111 1001 0001
BIC 4 : 1100 1000 0111 0101
TRANSFER ORDER
BIT PATTERNS OF BLOCK IDENTIFICATION CODE

FIG.9A

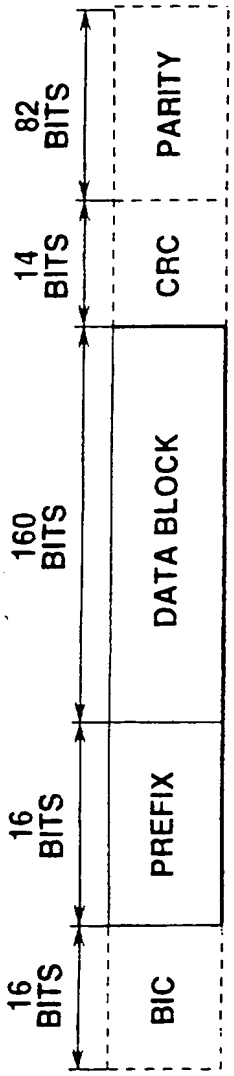

16 BITS
BIC
16 BITS
PREFIX
160 BITS
DATA BLOCK
14 BITS
CRC
82 BITS
PARITY

FIG.9B

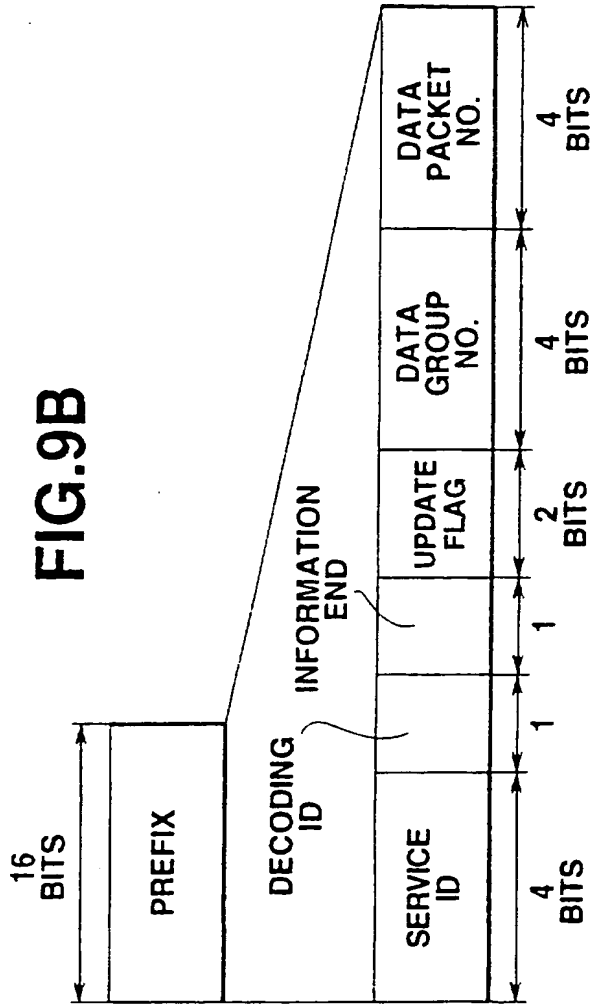

16 BITS
PREFIX
DECODING ID
INFORMATION END
SERVICE ID
4 BITS
1
1
UPDATE FLAG
2 BITS
DATA GROUP NO.
4 BITS
DATA PACKET NO.
4 BITS

FIG.10

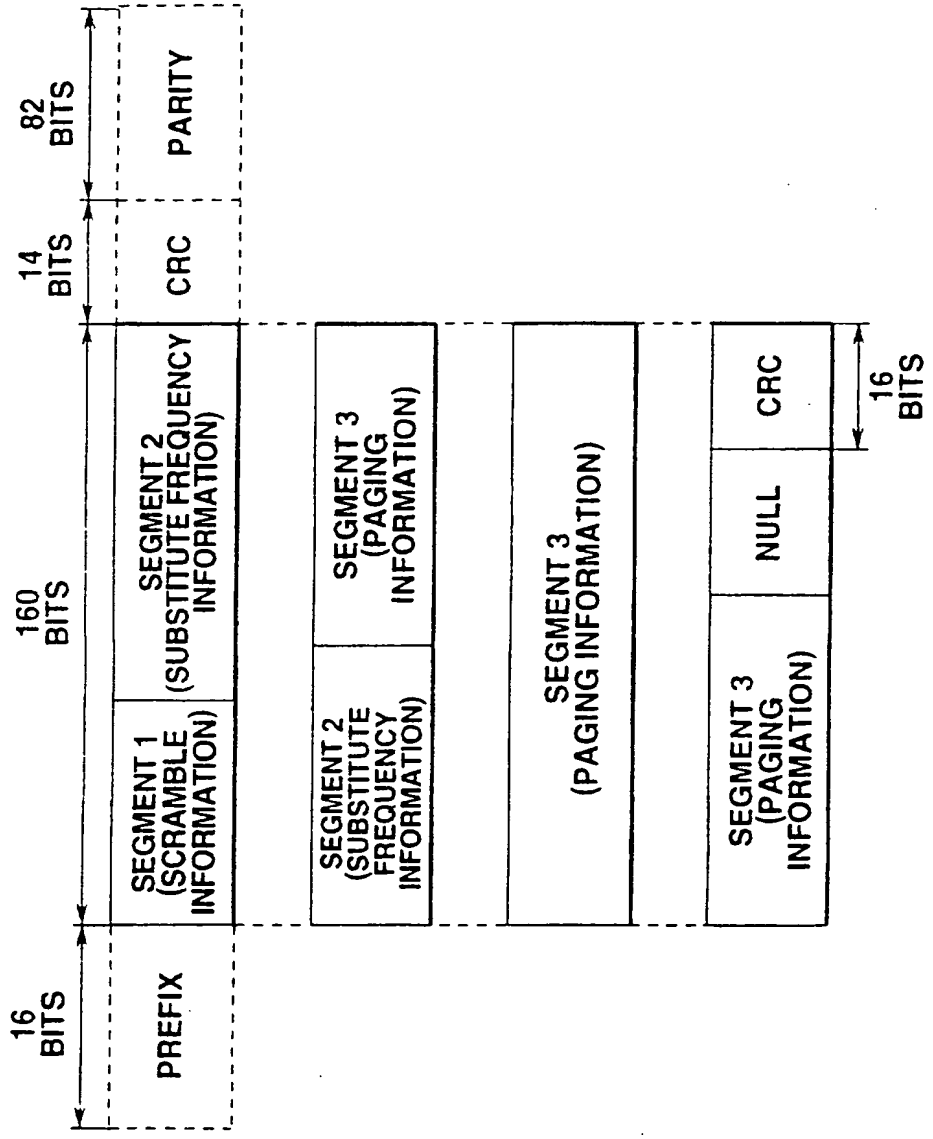

16 BITS
PREFIX
160 BITS
SEGMENT 1 (SCRAMBLE INFORMATION)
SEGMENT 2 (SUBSTITUTE FREQUENCY INFORMATION)
14 BITS
CRC
82 BITS
PARITY
SEGMENT 2 (SUBSTITUTE FREQUENCY INFORMATION)
SEGMENT 3 (PAGING INFORMATION)
SEGMENT 3 (PAGING INFORMATION)
SEGMENT 3 (PAGING INFORMATION)
NULL
CRC
16 BITS

FIG.11

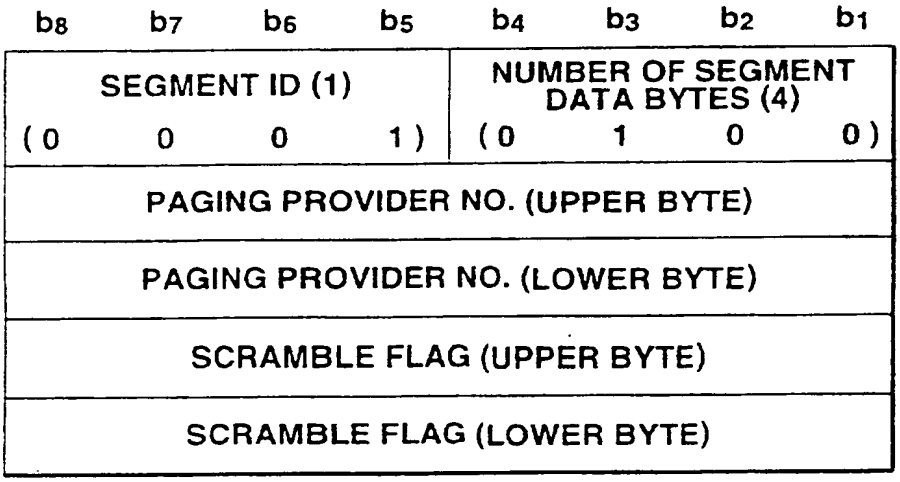

b8 b7 b6 b5 b4 b3 b2 b1
SEGMENT ID (1)
(0 0 0 1)
NUMBER OF SEGMENT DATA BYTES (4)
(0 1 0 0)
PAGING PROVIDER NO. (UPPER BYTE)
PAGING PROVIDER NO. (LOWER BYTE)
SCRAMBLE FLAG (UPPER BYTE)
SCRAMBLE FLAG (LOWER BYTE)

FIG.12

b8	b7	b6	b5	b4	b3	b2	b1
SEGMENT ID (A) (1 0 1 0)				NUMBER OF SEGMENT DATA BYTES			
NUMBER OF SEGMENT DATA BYTES (WHEN THE NUMBER OF BYTES IS 15 OR GREATER)							
REFERENCE BROADCASTING STATION FREQUENCY (FIRST)							
SUBSTITUTE FREQUENCY (FIRST)							
SUBSTITUTE FREQUENCY (SECOND)							
⋮							
SUBSTITUTE FREQUENCY (N_1-TH)							
SEGMENT ID (A) (1 0 1 0)				NUMBER OF SEGMENT DATA BYTES			
NUMBER OF SEGMENT DATA BYTES (WHEN THE NUMBER OF BYTES IS 15 OR GREATER)							
REFERENCE BROADCASTING STATION FREQUENCY (SECOND)							
SUBSTITUTE FREQUENCY (FIRST)							
SUBSTITUTE FREQUENCY (SECOND)							
⋮							
SUBSTITUTE FREQUENCY (N_2-TH)							
⋮							
SEGMENT ID (A) (1 0 1 0)				NUMBER OF SEGMENT DATA BYTES			
NUMBER OF SEGMENT DATA BYTES (WHEN THE NUMBER OF BYTES IS 15 OR GREATER)							
REFERENCE BROADCASTING STATION FREQUENCY (M-TH)							
SUBSTITUTE FREQUENCY (FIRST)							
SUBSTITUTE FREQUENCY (SECOND)							
⋮							
SUBSTITUTE FREQUENCY (N_M-TH)							

FIG.13

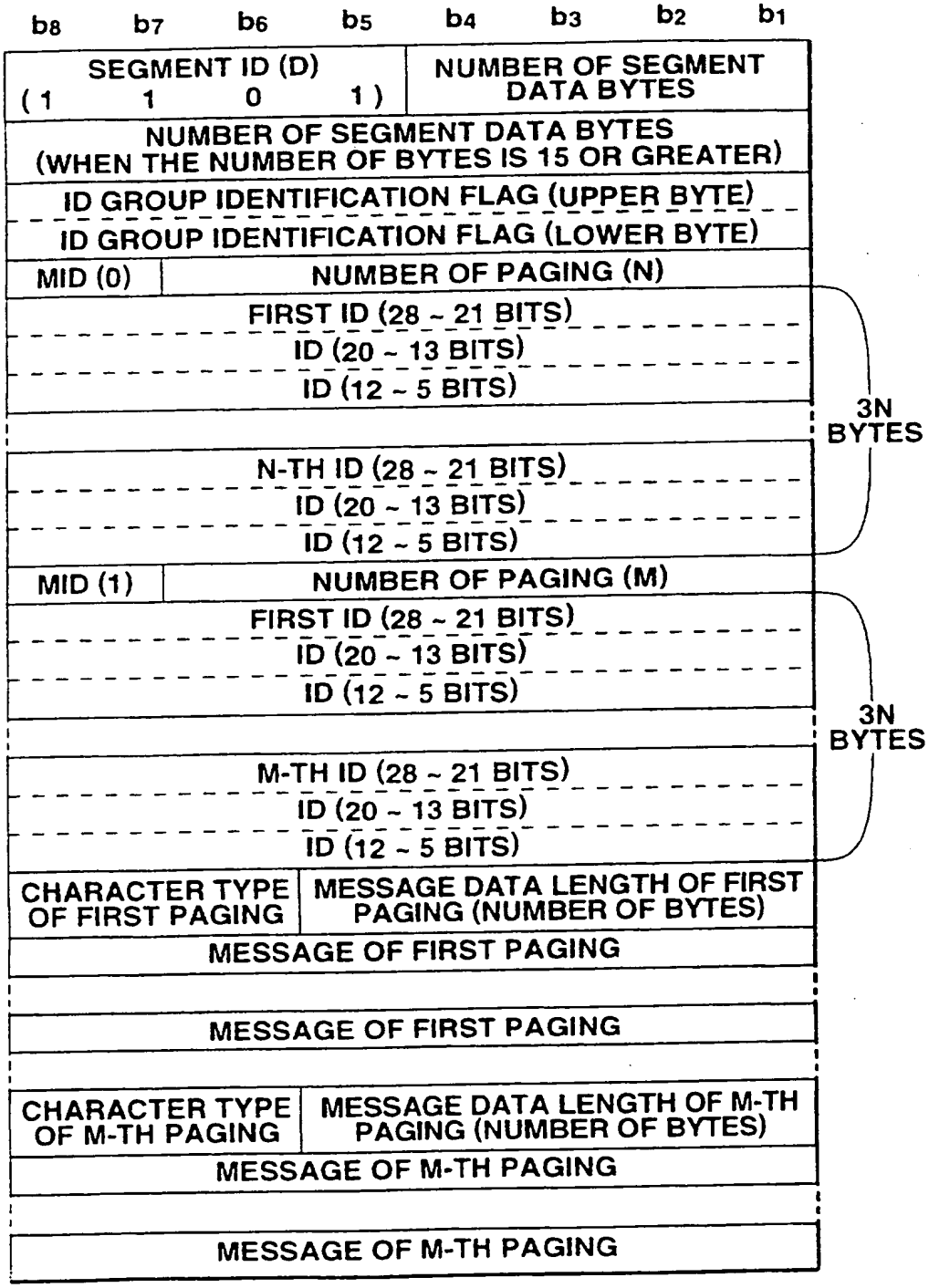

b8 b7 b6 b5 b4 b3 b2 b1
SEGMENT ID (D)
(1 1 0 1)
NUMBER OF SEGMENT DATA BYTES
NUMBER OF SEGMENT DATA BYTES
(WHEN THE NUMBER OF BYTES IS 15 OR GREATER)
ID GROUP IDENTIFICATION FLAG (UPPER BYTE)
ID GROUP IDENTIFICATION FLAG (LOWER BYTE)
MID (0)
NUMBER OF PAGING (N)
FIRST ID (28 ~ 21 BITS)
ID (20 ~ 13 BITS)
ID (12 ~ 5 BITS)
N-TH ID (28 ~ 21 BITS)
ID (20 ~ 13 BITS)
ID (12 ~ 5 BITS)
3N BYTES
MID (1)
NUMBER OF PAGING (M)
FIRST ID (28 ~ 21 BITS)
ID (20 ~ 13 BITS)
ID (12 ~ 5 BITS)
M-TH ID (28 ~ 21 BITS)
ID (20 ~ 13 BITS)
ID (12 ~ 5 BITS)
3N BYTES
CHARACTER TYPE OF FIRST PAGING
MESSAGE DATA LENGTH OF FIRST PAGING (NUMBER OF BYTES)
MESSAGE OF FIRST PAGING
MESSAGE OF FIRST PAGING
CHARACTER TYPE OF M-TH PAGING
MESSAGE DATA LENGTH OF M-TH PAGING (NUMBER OF BYTES)
MESSAGE OF M-TH PAGING
MESSAGE OF M-TH PAGING

FIG.14

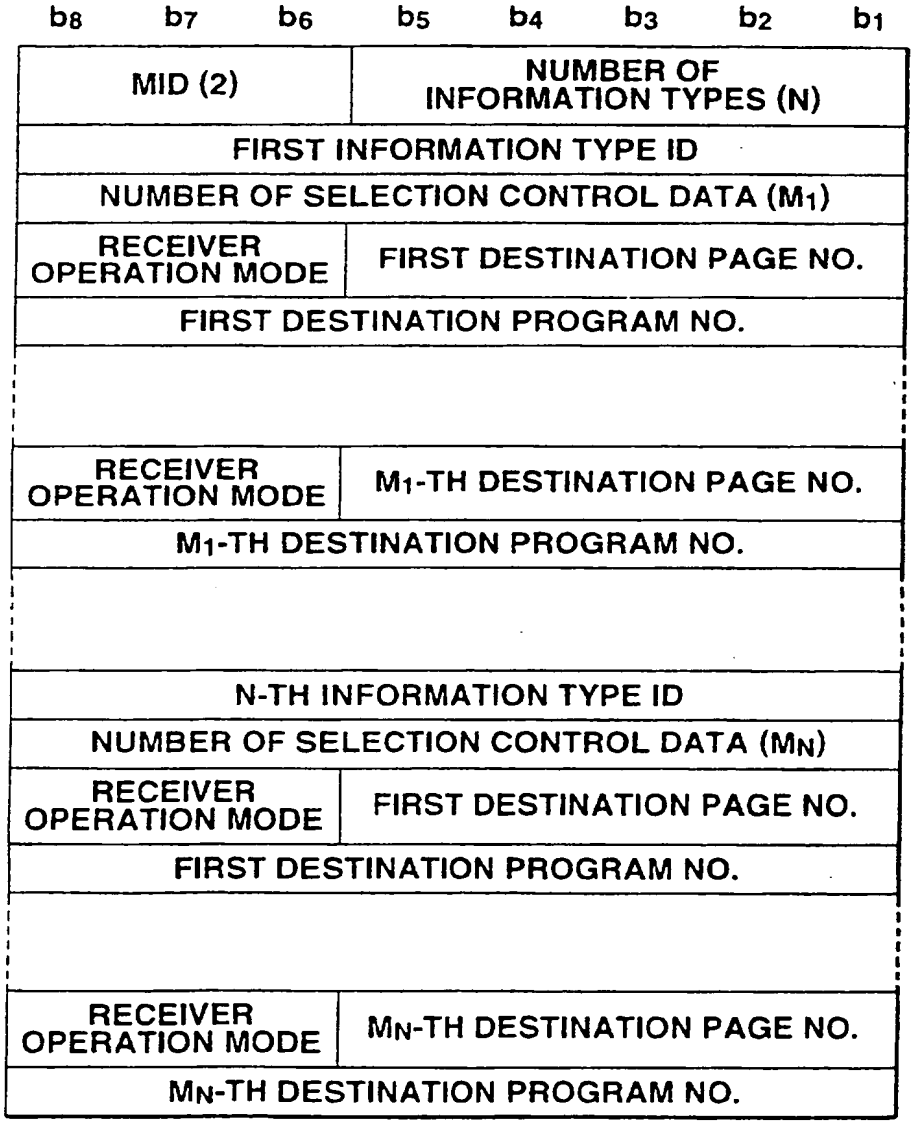

b8 b7 b6 b5 b4 b3 b2 b1
MID (2)
NUMBER OF INFORMATION TYPES (N)
FIRST INFORMATION TYPE ID
NUMBER OF SELECTION CONTROL DATA (M1)
RECEIVER OPERATION MODE
FIRST DESTINATION PAGE NO.
FIRST DESTINATION PROGRAM NO.
RECEIVER OPERATION MODE
M1-TH DESTINATION PAGE NO.
M1-TH DESTINATION PROGRAM NO.
N-TH INFORMATION TYPE ID
NUMBER OF SELECTION CONTROL DATA (MN)
RECEIVER OPERATION MODE
FIRST DESTINATION PAGE NO.
FIRST DESTINATION PROGRAM NO.
RECEIVER OPERATION MODE
MN-TH DESTINATION PAGE NO.
MN-TH DESTINATION PROGRAM NO.

FIG.15

RECEIVER OPERATION MODE	CONTENTS (EXAMPLE)
0	STORE ONLY
1	ALERT/STORE
2	ALERT/DISPLAY
3	ALERT ONLY

FIG.16

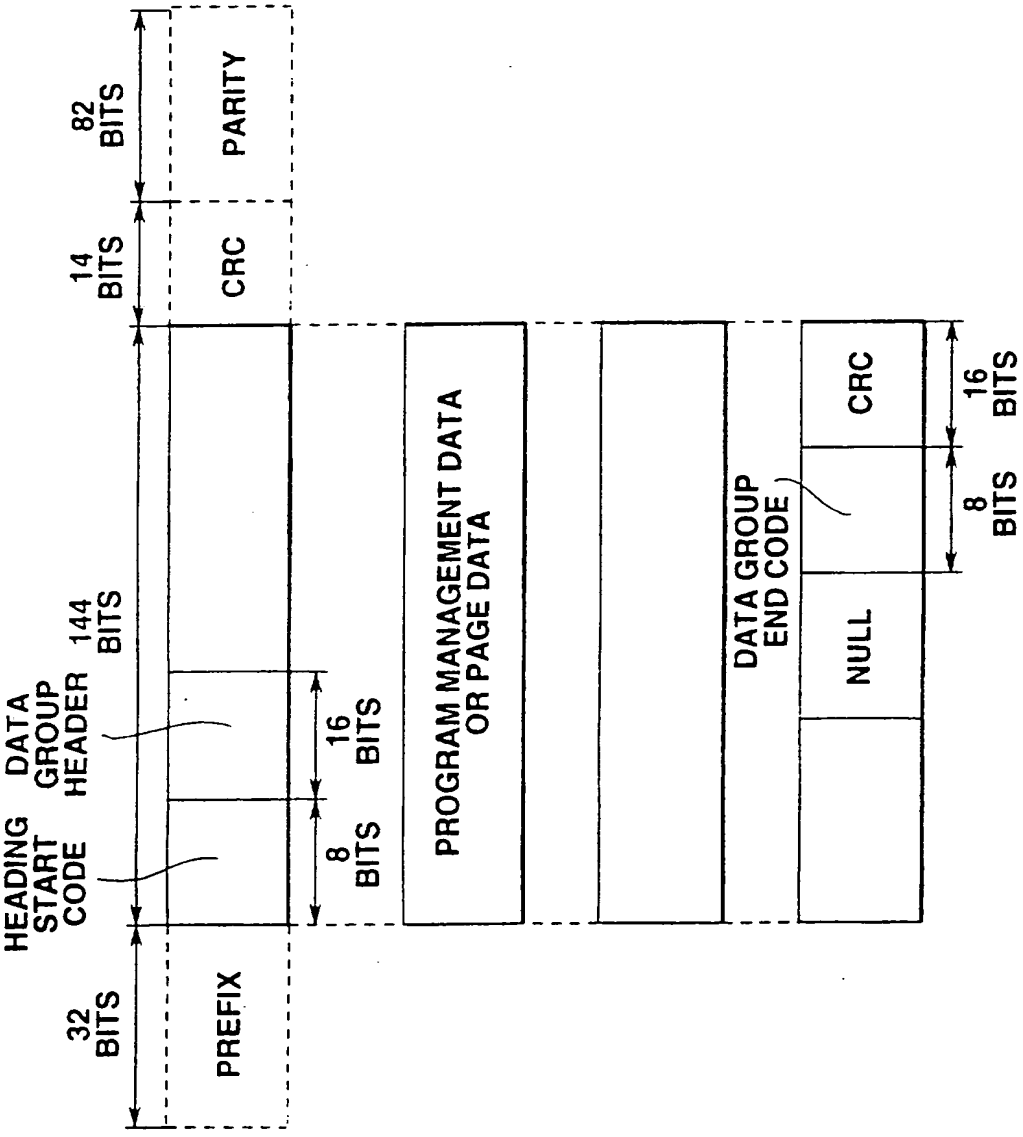

82 BITS
PARITY
14 BITS
CRC
144 BITS
DATA GROUP HEADER
16 BITS
HEADING START CODE
8 BITS
PROGRAM MANAGEMENT DATA OR PAGE DATA
DATA GROUP END CODE
CRC
16 BITS
8 BITS
NULL
32 BITS
PREFIX

FIG.17

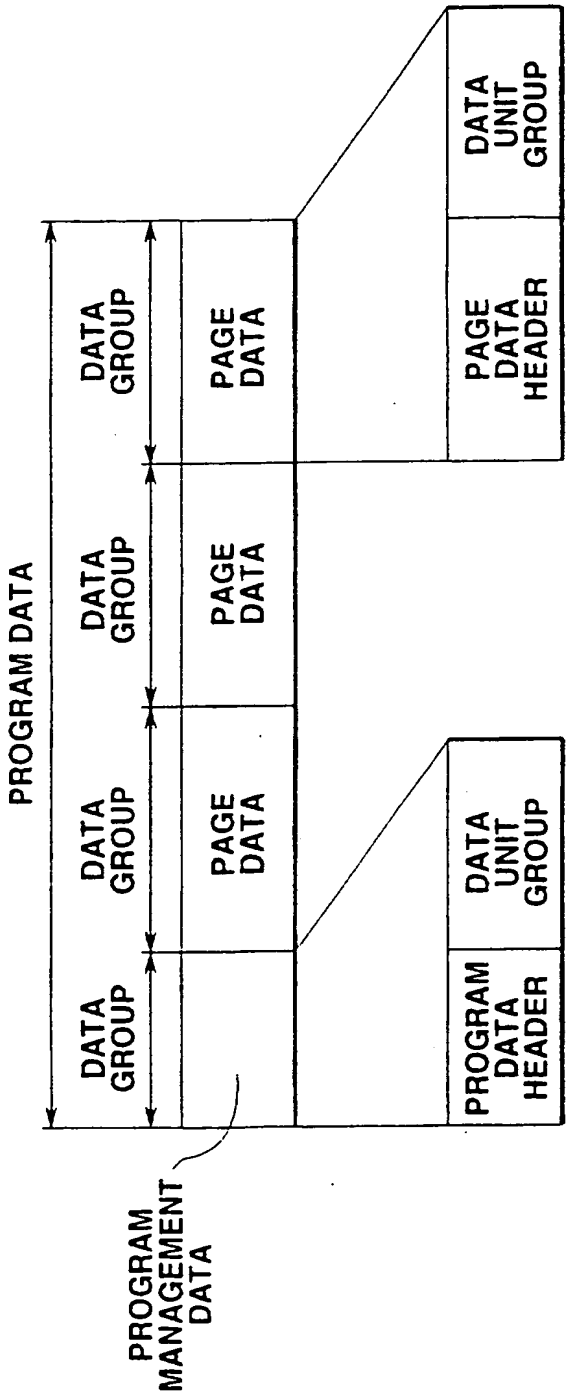

PROGRAM DATA
DATA GROUP
DATA GROUP
DATA GROUP
PAGE DATA
PAGE DATA
PAGE DATA
PAGE DATA HEADER
DATA UNIT GROUP
PROGRAM DATA HEADER
DATA UNIT GROUP
PROGRAM MANAGEMENT DATA

FIG.18A

PROGRAM DATA HEADER

	b8	b7	b6	b5	b4	b3	b2	b1	
DB(n)	INFORMATION SEPARATION CODE (RS)								DATA HEADER ID
DB(n+1)	DATA HEAD PARAMETER								
DB(n+2)	PROGRAM NO.								DATA HEADER DATA
DB(n+3)	UPDATE FLAG		TOTAL NUMBER OF PAGES						
DB(n+4)	PRESENTATION FUNCTION								
DB(n+5)	INFORMATION CATEGORY				DISPLAY FORMAT				

FIG.18B

DATA UNIT

	b8	b7	b6	b5	b4	b3	b2	b1	
PB1	DATA UNIT SEPARATION CODE (US)								DATA UNIT ID
PB2	DATA UNIT PARAMETER								
PB3	DUL	DATA UNIT SIZE							
PB4	DATA UNIT SIZE								
PB5	DATA UNIT DATA								
PB6									
PB									
PB									
PB									
PB									
PB									

DUL : DATA UNIT LINK FLAG

FIG.19A

PAGE DATA HEADER

	b8	b7	b6	b5	b4	b3	b2	b1	
DB(n)	INFORMATION SEPARATION CODE (RS)								DATA HEADER ID
DB(n+1)	DATA HEAD PARAMETER								
DB(n+2)	PROGRAM NO.								DATA HEADER DATA
DB(n+3)	UPDATE FLAG		PAGE NO.						
DB(n+4)	PRESENTATION FUNCTION								
DB(n+5)	INFORMATION CATEGORY				DISPLAY FORMAT				
DB(n+6)	HEADER RASTER COLOR				RASTER COLOR				

FIG.19B

DATA UNIT

	b8	b7	b6	b5	b4	b3	b2	b1	
PB1	DATA UNIT SEPARATION CODE (US)								DATA UNIT ID
PB2	DATA UNIT PARAMETER								
PB3	DUL	DATA UNIT SIZE							
PB4	DATA UNIT SIZE								
PB5	DATA UNIT DATA								
PB6									
PB									
PB									
PB									
PB									
PB									
PB									

DUL : DATA UNIT LINK FLAG

FIG.20

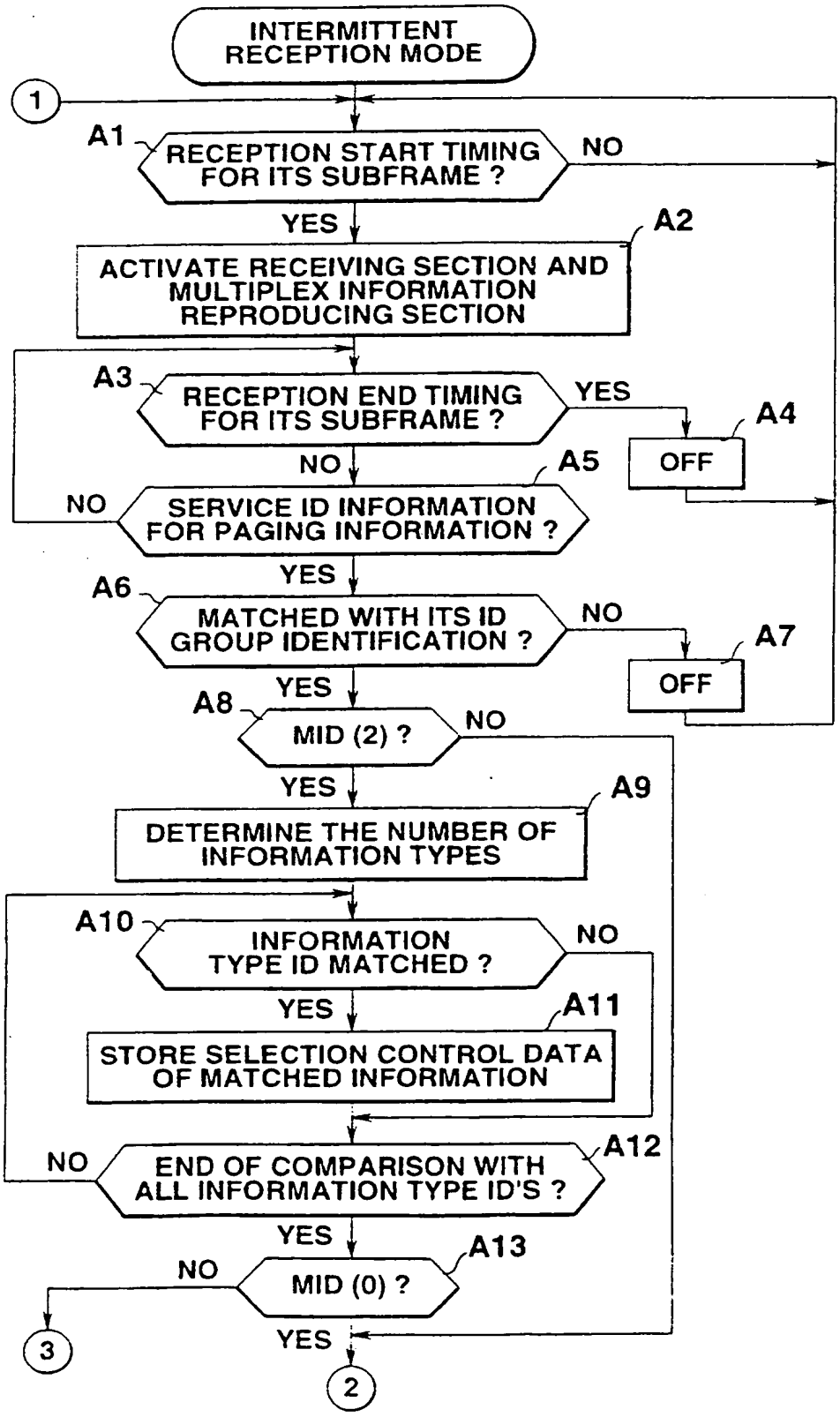

INTERMITTENT RECEPTION MODE
1
A1
RECEPTION START TIMING FOR ITS SUBFRAME ?
NO
YES
A2
ACTIVATE RECEIVING SECTION AND MULTIPLEX INFORMATION REPRODUCING SECTION
A3
RECEPTION END TIMING FOR ITS SUBFRAME ?
YES
A4
OFF
NO
A5
NO
SERVICE ID INFORMATION FOR PAGING INFORMATION ?
YES
A6
MATCHED WITH ITS ID GROUP IDENTIFICATION ?
NO
A7
OFF
YES
A8
MID (2) ?
NO
YES
A9
DETERMINE THE NUMBER OF INFORMATION TYPES
A10
INFORMATION TYPE ID MATCHED ?
NO
YES
A11
STORE SELECTION CONTROL DATA OF MATCHED INFORMATION
NO
A12
END OF COMPARISON WITH ALL INFORMATION TYPE ID'S ?
YES
A13
NO
MID (0) ?
3
YES
2

FIG.21

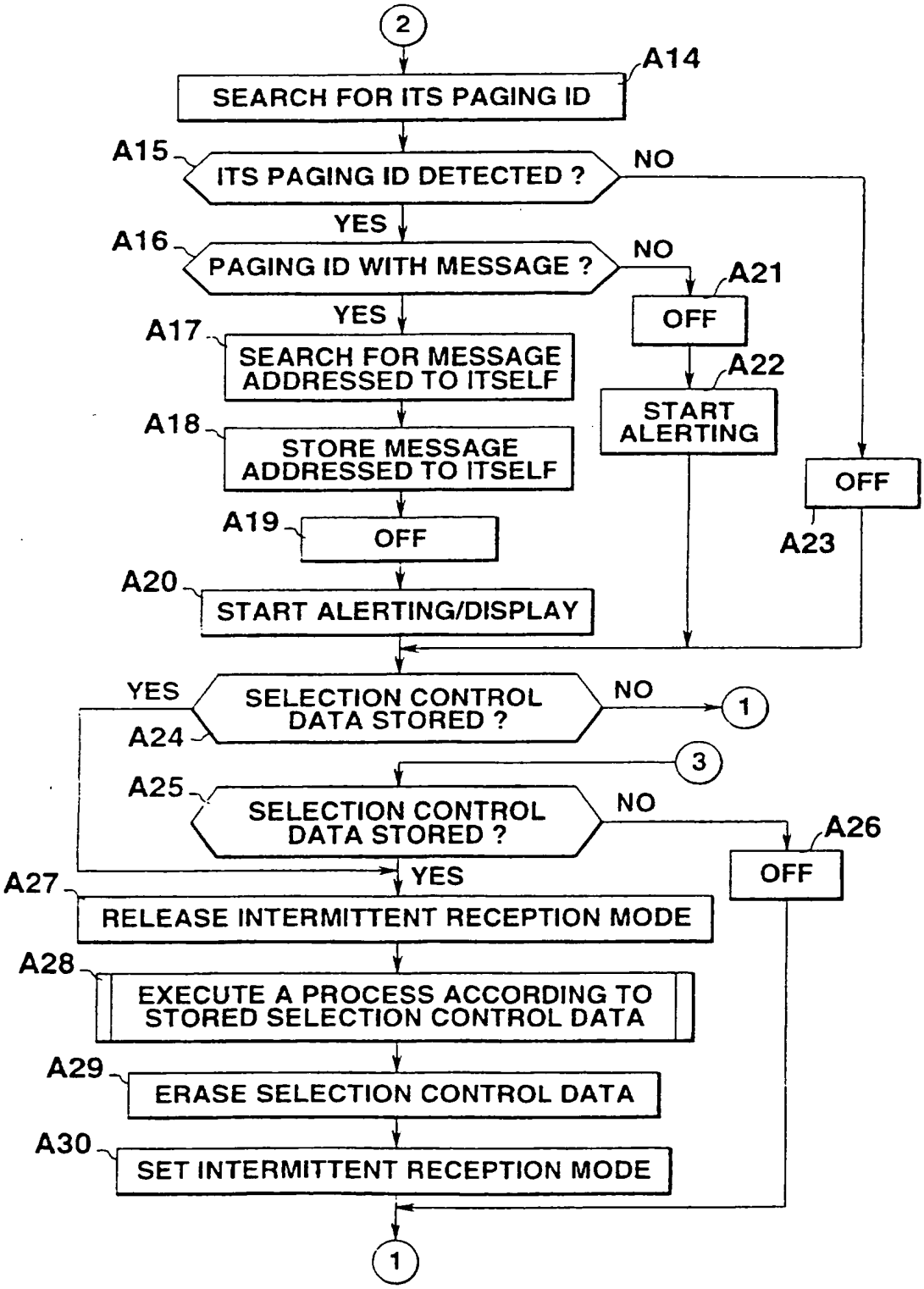
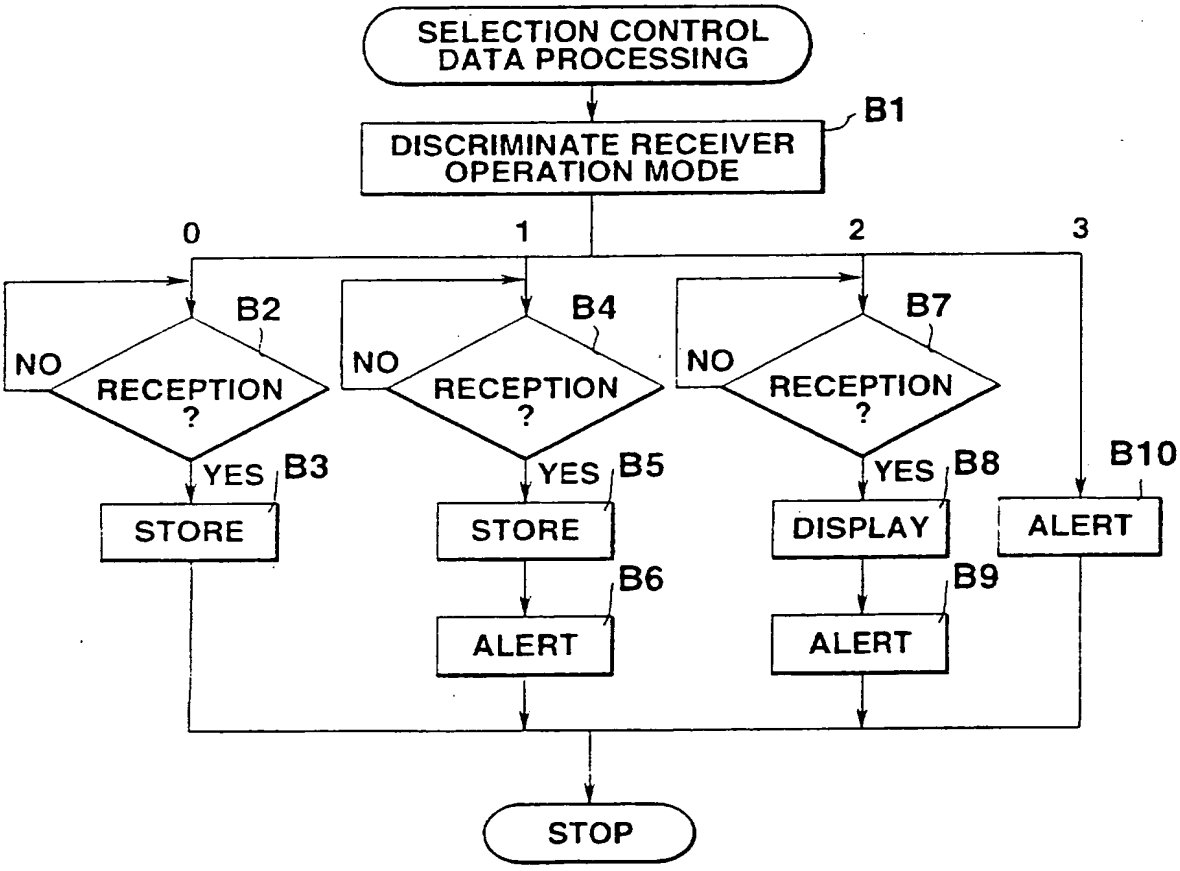

2
A14
SEARCH FOR ITS PAGING ID
A15
ITS PAGING ID DETECTED ?
NO
YES
A16
PAGING ID WITH MESSAGE ?
NO
A21
OFF
YES
A17
SEARCH FOR MESSAGE ADDRESSED TO ITSELF
A22
START ALERTING
A18
STORE MESSAGE ADDRESSED TO ITSELF
OFF
A19
OFF
A23
A20
START ALERTING/DISPLAY
YES
SELECTION CONTROL DATA STORED ?
NO
1
A24
3
A25
SELECTION CONTROL DATA STORED ?
NO
A26
OFF
A27
YES
RELEASE INTERMITTENT RECEPTION MODE
A28
EXECUTE A PROCESS ACCORDING TO STORED SELECTION CONTROL DATA
A29
ERASE SELECTION CONTROL DATA
A30
SET INTERMITTENT RECEPTION MODE
1

FIG.22


SELECTION CONTROL DATA PROCESSING
DISCRIMINATE RECEIVER OPERATION MODE
B1
0
1
2
3
B2
NO
RECEPTION ?
YES
B3
STORE
B4
NO
RECEPTION ?
YES
B5
STORE
B6
ALERT
B7
NO
RECEPTION ?
YES
B8
DISPLAY
B9
ALERT
B10
ALERT
STOP

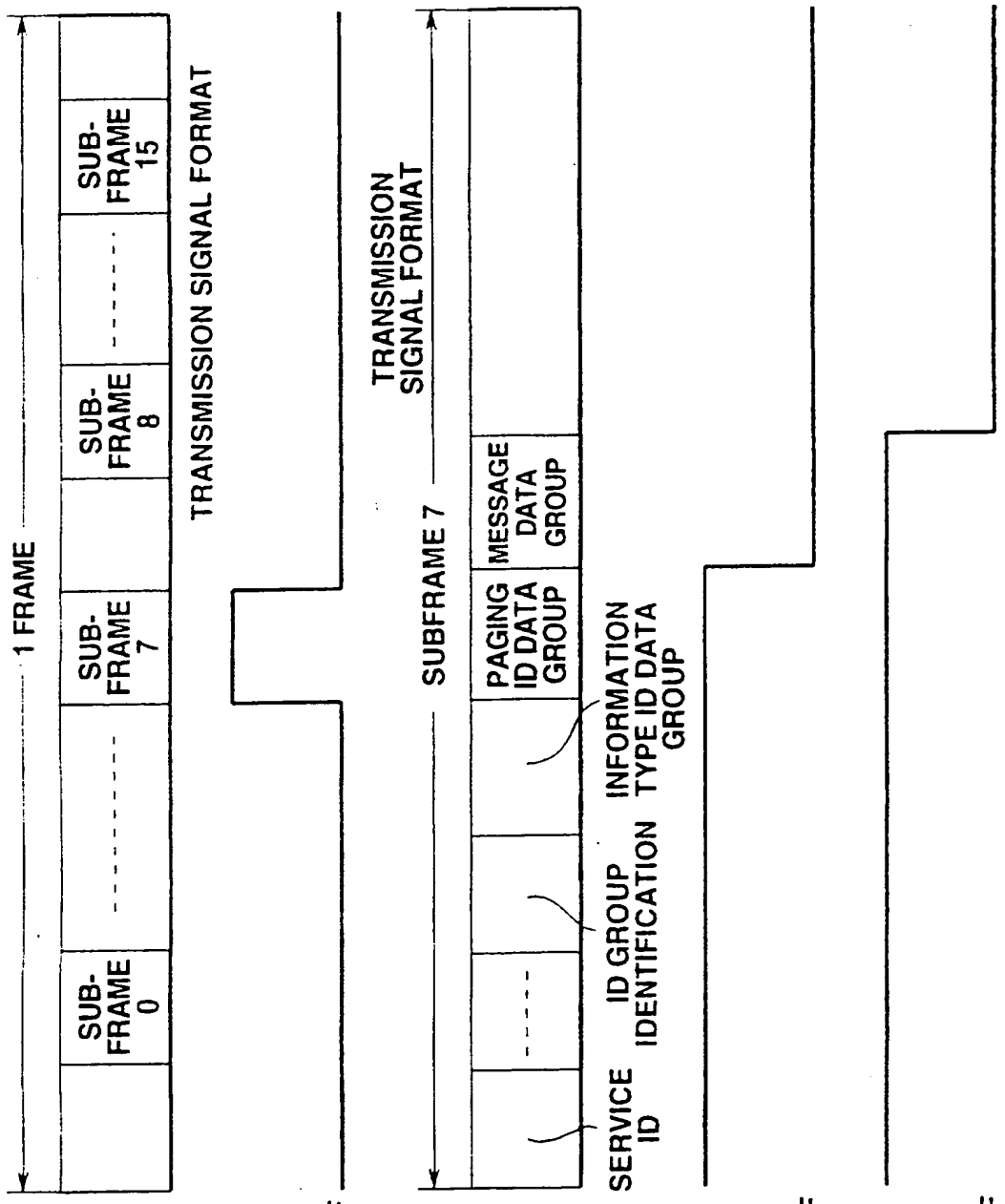


FIG.23A

FIG.23B

FIG.23C

FIG.23D

FIG.23E

FIG.24

23

INFORMATION TYPE ID	RECEIVER OPERATION MODE
0	2
3	1
⋮	⋮

FIG.25A

19

PROGRAM CATEGORY NO.	PROGRAM CATEGORY NAME
01	FASHION
02	FOOD
03	
04	
⋮	⋮
n	

PROGRAM INDEX NO.	PROGRAM INDEX NAME
01	CLOTHS
02	BAG
03	SHOES
04	
⋮	⋮
m	

FIG.25B

20

PROGRAM CATEGORY NO.
03
05
06
⋮

PROGRAM INDEX NO.
01
07
08
⋮

FIG.26

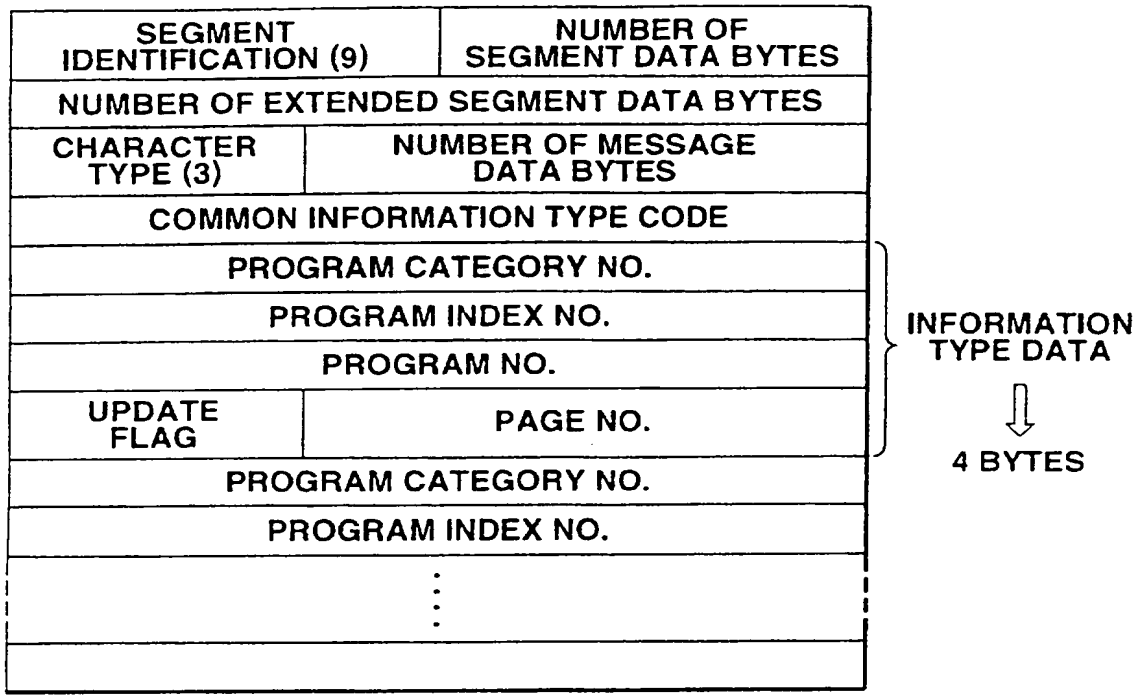

SEGMENT IDENTIFICATION (9)
NUMBER OF SEGMENT DATA BYTES
NUMBER OF EXTENDED SEGMENT DATA BYTES
CHARACTER TYPE (3)
NUMBER OF MESSAGE DATA BYTES
COMMON INFORMATION TYPE CODE
PROGRAM CATEGORY NO.
PROGRAM INDEX NO.
PROGRAM NO.
UPDATE FLAG
PAGE NO.
PROGRAM CATEGORY NO.
PROGRAM INDEX NO.
INFORMATION TYPE DATA
4 BYTES

FIG.27

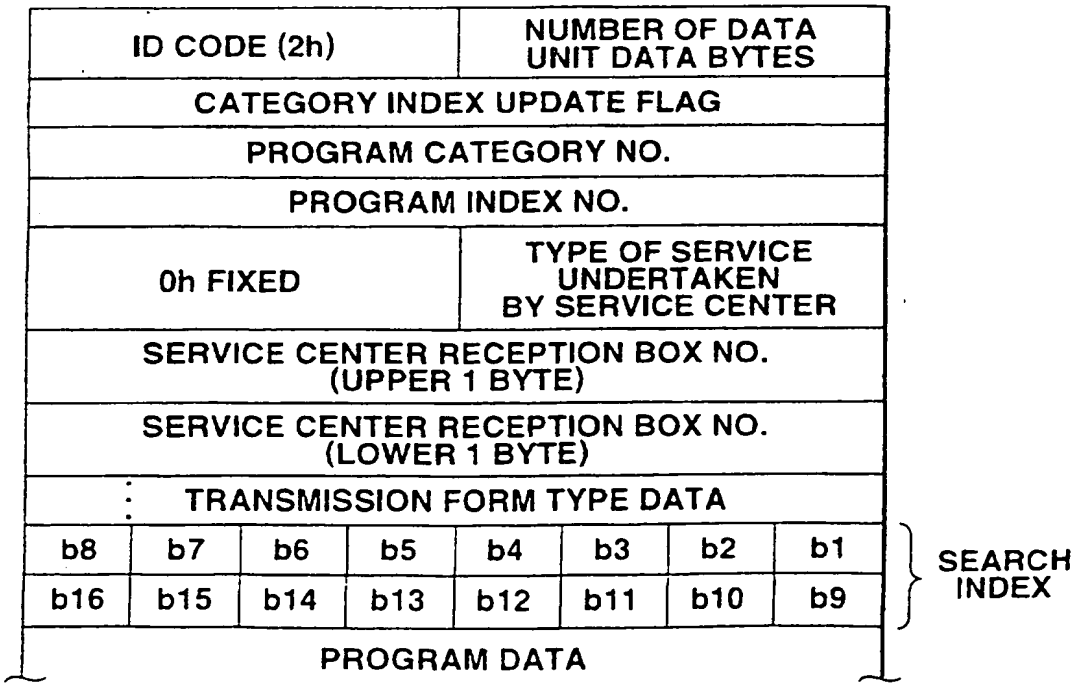

ID CODE (2h)
NUMBER OF DATA UNIT DATA BYTES
CATEGORY INDEX UPDATE FLAG
PROGRAM CATEGORY NO.
PROGRAM INDEX NO.
0h FIXED
TYPE OF SERVICE UNDERTAKEN BY SERVICE CENTER
SERVICE CENTER RECEPTION BOX NO. (UPPER 1 BYTE)
SERVICE CENTER RECEPTION BOX NO. (LOWER 1 BYTE)
TRANSMISSION FORM TYPE DATA
b8 b7 b6 b5 b4 b3 b2 b1
b16 b15 b14 b13 b12 b11 b10 b9
SEARCH INDEX
PROGRAM DATA

FIG.28

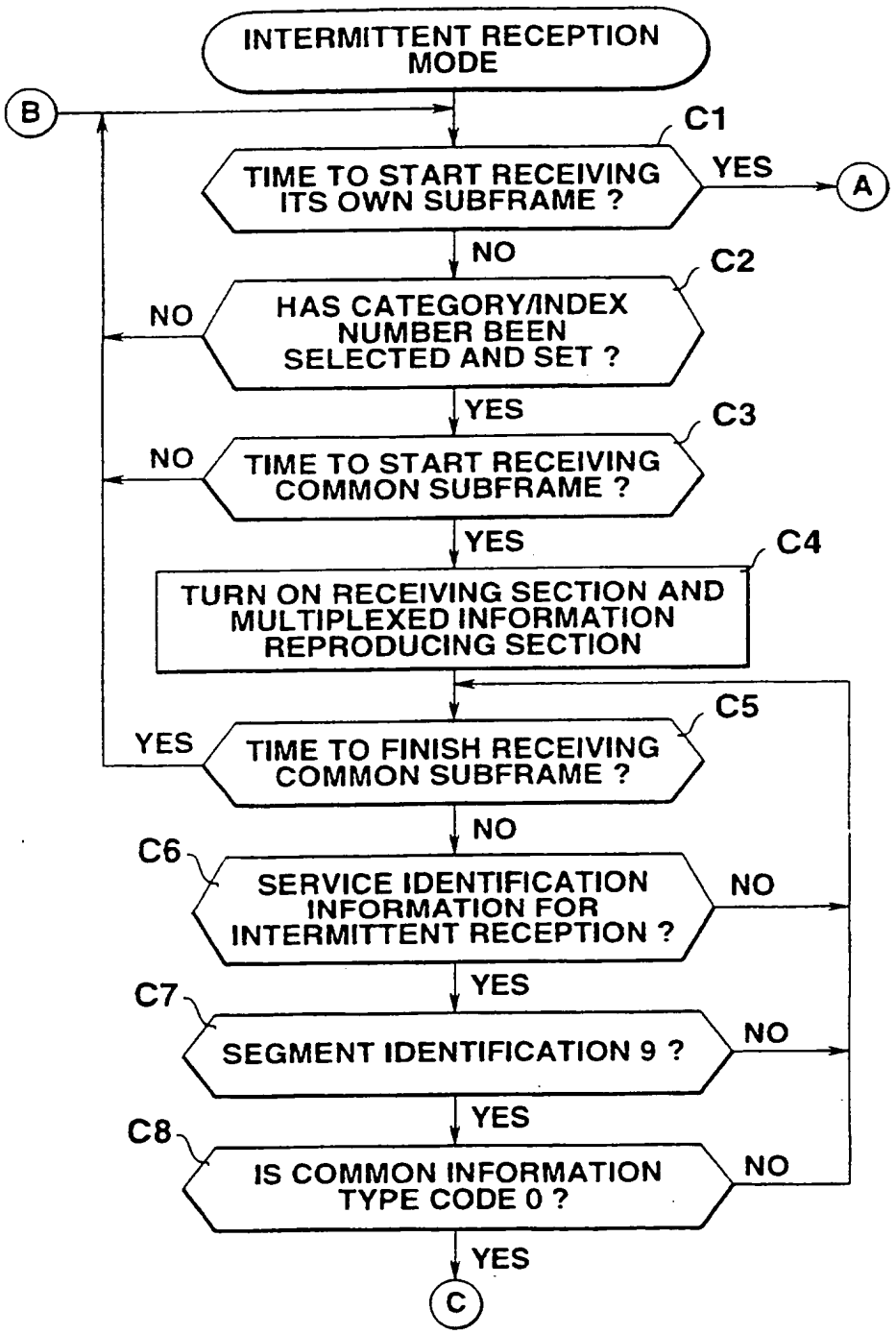

INTERMITTENT RECEPTION MODE
B
C1
TIME TO START RECEIVING ITS OWN SUBFRAME ?
YES
A
NO
C2
HAS CATEGORY/INDEX NUMBER BEEN SELECTED AND SET ?
NO
YES
C3
TIME TO START RECEIVING COMMON SUBFRAME ?
NO
YES
C4
TURN ON RECEIVING SECTION AND MULTIPLEXED INFORMATION REPRODUCING SECTION
C5
TIME TO FINISH RECEIVING COMMON SUBFRAME ?
YES
NO
C6
SERVICE IDENTIFICATION INFORMATION FOR INTERMITTENT RECEPTION ?
NO
YES
C7
SEGMENT IDENTIFICATION 9 ?
NO
YES
C8
IS COMMON INFORMATION TYPE CODE 0 ?
NO
YES
C

FIG.29

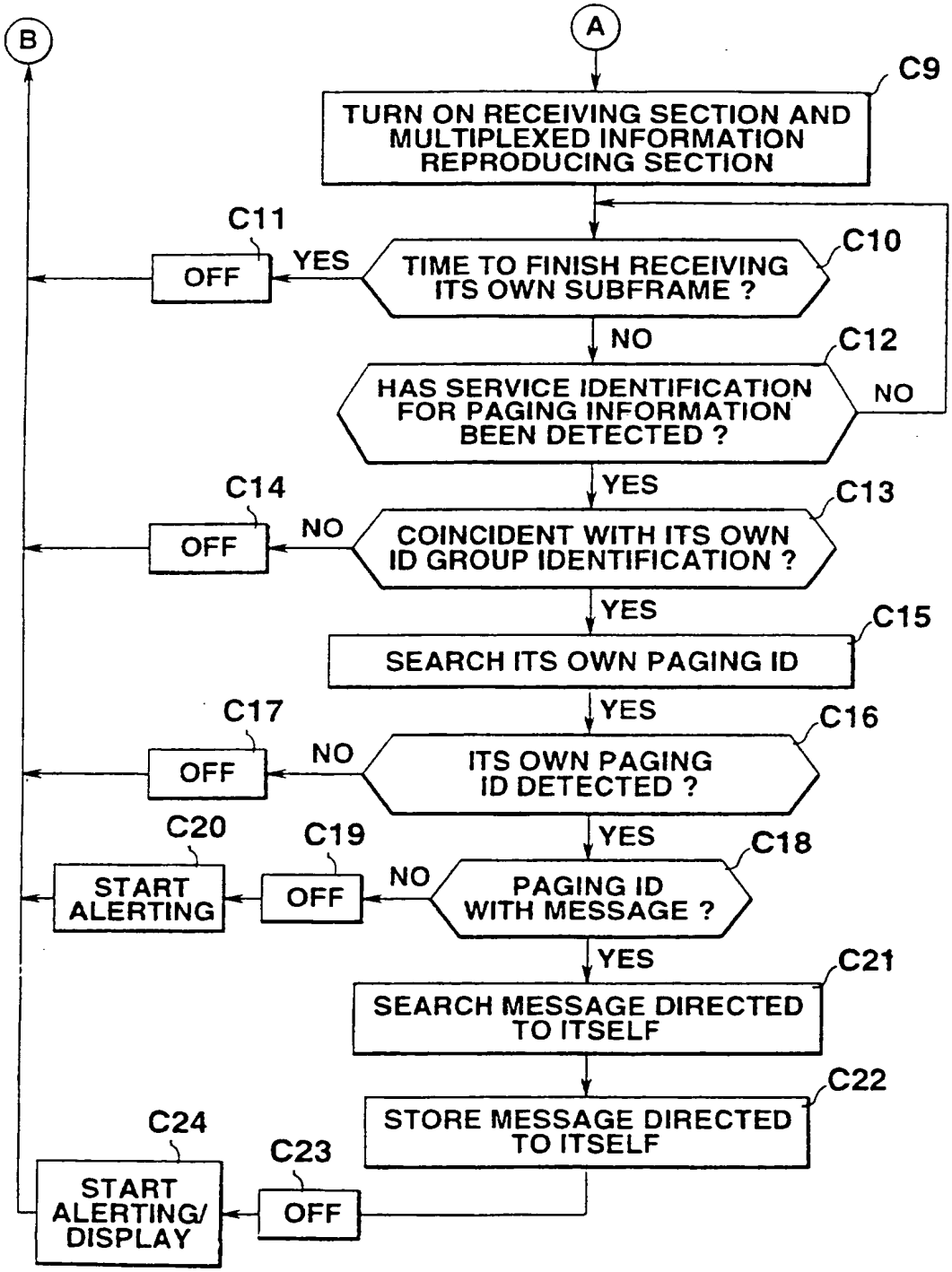

A
B
C9
TURN ON RECEIVING SECTION AND MULTIPLEXED INFORMATION REPRODUCING SECTION
C10
TIME TO FINISH RECEIVING ITS OWN SUBFRAME ?
YES
C11
OFF
NO
C12
HAS SERVICE IDENTIFICATION FOR PAGING INFORMATION BEEN DETECTED ?
NO
YES
C13
COINCIDENT WITH ITS OWN ID GROUP IDENTIFICATION ?
NO
C14
OFF
YES
C15
SEARCH ITS OWN PAGING ID
YES
C16
ITS OWN PAGING ID DETECTED ?
NO
C17
OFF
YES
C18
PAGING ID WITH MESSAGE ?
NO
C19
OFF
C20
START ALERTING
YES
C21
SEARCH MESSAGE DIRECTED TO ITSELF
C22
STORE MESSAGE DIRECTED TO ITSELF
C23
OFF
C24
START ALERTING/ DISPLAY

FIG.30

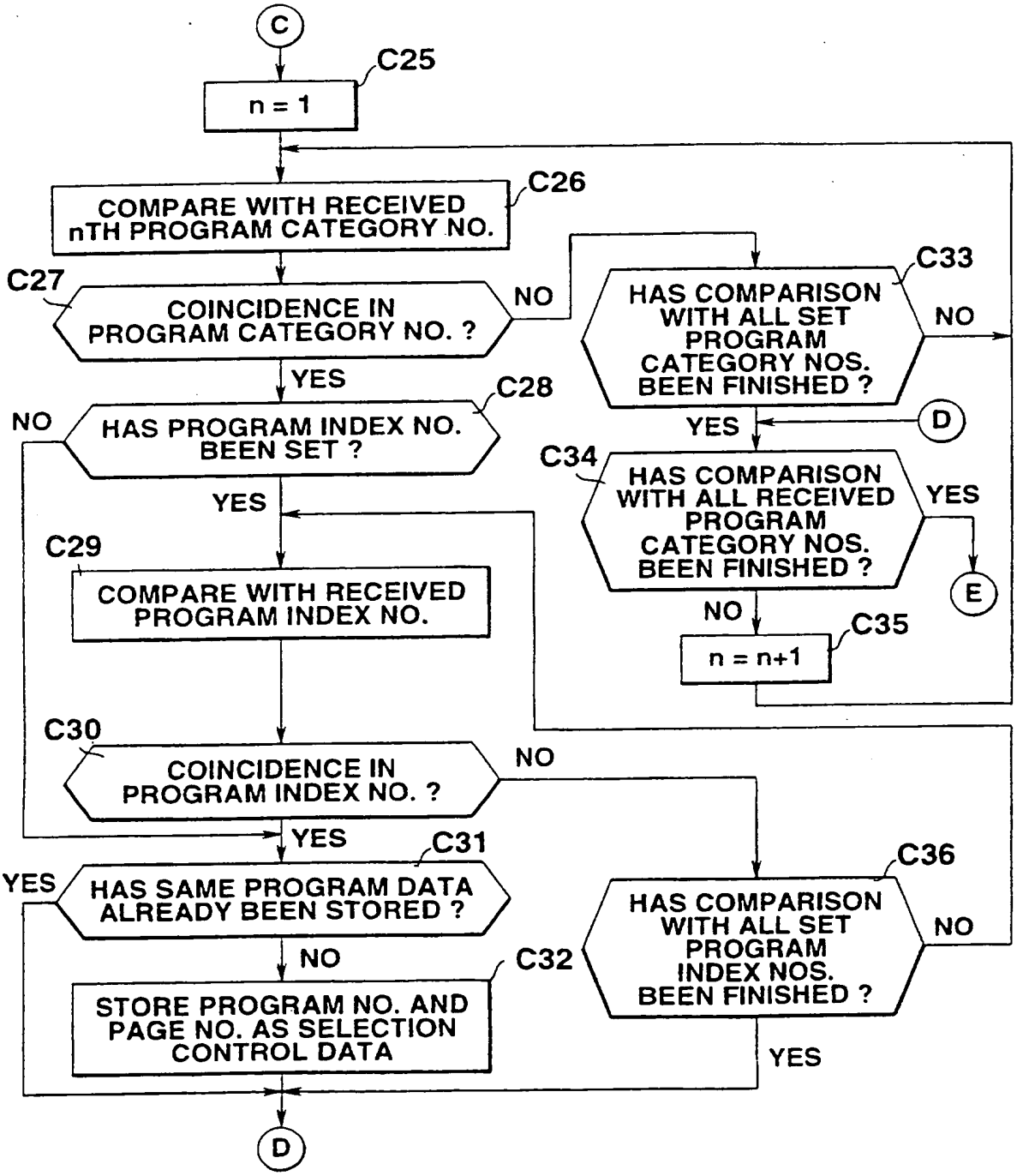
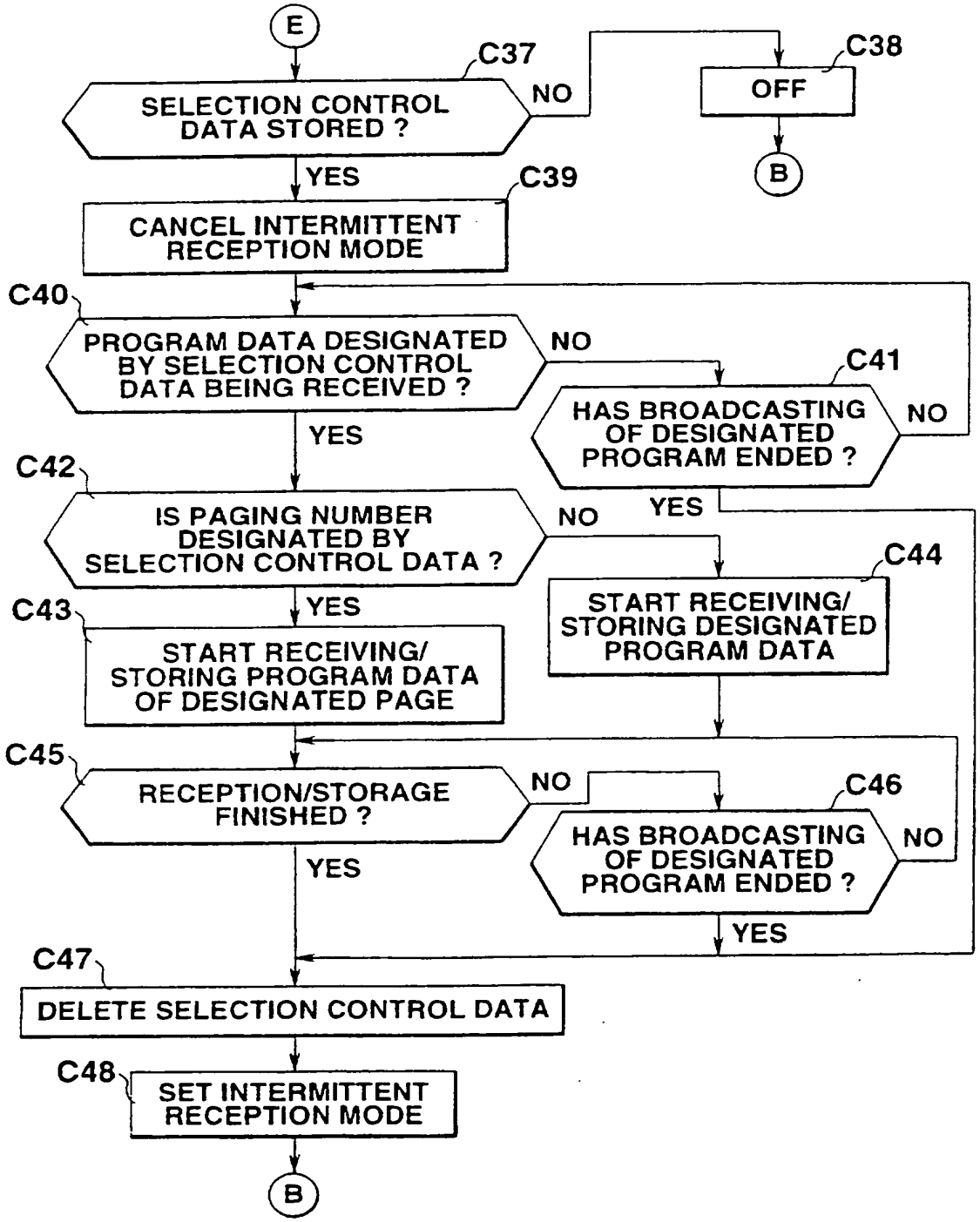

C
C25
n = 1
C26
COMPARE WITH RECEIVED nTH PROGRAM CATEGORY NO.
C27
COINCIDENCE IN PROGRAM CATEGORY NO. ?
NO
YES
C28
HAS PROGRAM INDEX NO. BEEN SET ?
NO
YES
C29
COMPARE WITH RECEIVED PROGRAM INDEX NO.
C30
COINCIDENCE IN PROGRAM INDEX NO. ?
NO
YES
C31
YES
HAS SAME PROGRAM DATA ALREADY BEEN STORED ?
NO
C32
STORE PROGRAM NO. AND PAGE NO. AS SELECTION CONTROL DATA
D
C33
HAS COMPARISON WITH ALL SET PROGRAM CATEGORY NOS. BEEN FINISHED ?
NO
YES
D
C34
HAS COMPARISON WITH ALL RECEIVED PROGRAM CATEGORY NOS. BEEN FINISHED ?
YES
E
NO
C35
n = n+1
C36
HAS COMPARISON WITH ALL SET PROGRAM INDEX NOS. BEEN FINISHED ?
NO
YES

FIG.31


E
C37
SELECTION CONTROL DATA STORED ?
NO
C38
OFF
B
YES
C39
CANCEL INTERMITTENT RECEPTION MODE
C40
PROGRAM DATA DESIGNATED BY SELECTION CONTROL DATA BEING RECEIVED ?
NO
C41
HAS BROADCASTING OF DESIGNATED PROGRAM ENDED ?
NO
YES
C42
IS PAGING NUMBER DESIGNATED BY SELECTION CONTROL DATA ?
NO
YES
C44
START RECEIVING/ STORING DESIGNATED PROGRAM DATA
C43
START RECEIVING/ STORING PROGRAM DATA OF DESIGNATED PAGE
C45
RECEPTION/STORAGE FINISHED ?
NO
C46
HAS BROADCASTING OF DESIGNATED PROGRAM ENDED ?
NO
YES
YES
C47
DELETE SELECTION CONTROL DATA
C48
SET INTERMITTENT RECEPTION MODE
B

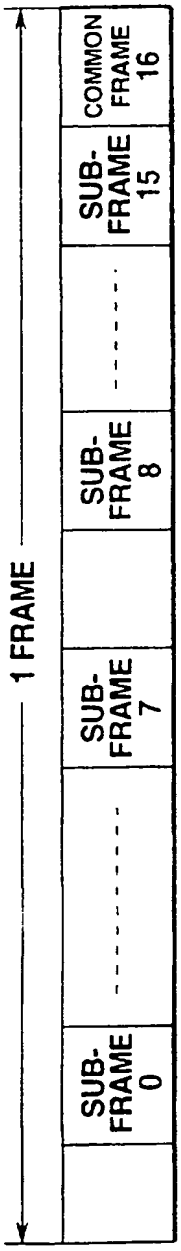


FIG.32A

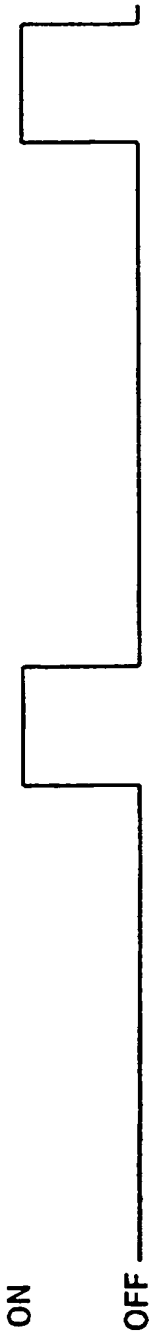


FIG.32B

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/JP 97/01272

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04H1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE 42 21 617 A (OPEL ADAM AG) 5 January 1994 see the whole document	1,8-11, 31-33 3-5,7, 12, 22-24, 26-30, 34-36
Y	WO 89 11199 A (VOGEL PETER S) 16 November 1989 see the whole document	3-5,7, 12, 22-24, 26-30, 34-36
X	US 5 134 719 A (MANKOVITZ ROY J) 28 July 1992 see the whole document	1,8-11, 31-33

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8 July 1997	23.07.1997

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European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Kelperis, K

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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